

ATTACHMENT 1

**ABC LABORATORY REPORT
BIOASSAY SAMPLE DATA FOR *Eisenia fetida***

Study Title

28-Day Survival, Weight Change and Bioaccumulation of *Eisenia fetida*
With Soil Samples Collected at Fort McClellan, Alabama

Author

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Scientist/Manager

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Performing Laboratory

ABC Laboratories, Inc.
Environmental Fate and Effects
7200 E. ABC Lane
Columbia, Missouri 65202

Report Completion Date

August 14, 2003

Laboratory Project Identification

ABC Study No. 48209

Shaw Project No.: 800486

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1.0 INTRODUCTION

As part of a remedial investigation at the Fort McClellan, Alabama, ABC Laboratories conducted toxicity tests on soil samples collected by Shaw Environmental field personnel. All soils were evaluated for effects on survival, weight change, and bioaccumulation for the earthworm, *Eisenia fetida*.

2.0 MATERIALS AND METHODS

2.1 Soil Samples

Soil samples were received at ABC Laboratories in multiple shipments on May 7,9,10,13, and 14, 2003. Soil samples were received in 1-gallon or 1-liter plastic jars packed in ice. Chain-of-custody documentation is presented in Appendix A. Soil samples were logged in and then refrigerated at approximately 4 °C until processing or use. Sample receipt and identification is presented in Table 1. Site samples RW0007, RW0008, RW0009, RW0016, and RW0023, were designated as reference sites.

2.2 Test Organisms

Adult earthworms (*Eisenia fetida*) at least 2 months old with a clitellum and weighing at least 300 mg were utilized for testing. All worms were obtained from in-house cultures maintained at ABC Laboratories.

2.3 Biological Test Procedures

The test procedures utilized in the performance of the 28-day earthworm toxicity and bioaccumulation tests were based upon those procedures described in "Protocols for Short Term Toxicity Screening of Hazardous Waste Sites" (1) and "Conducting Laboratory Soil Toxicity or Bioaccumulation Tests with the Lumbricid Earthworm *Eisenia fetida*" (2). The ABC control soil was replicated 20 times. The first 10 replicates were used to assess control survival, growth, and as baseline tissue for bioaccumulation. The second 10 replicates were for additional worm tissue for the bioaccumulation baseline. Each site soil sample was replicated 10 times. The first 5 replicates were used to assess survival, effect on growth, and as tissue for bioaccumulation. The second 5 replicates were for additional worm tissue for bioaccumulation. Each test chamber contained 10 worms and constituted a replicate. The test chambers were approximately 1-L glass jars containing 200 grams of site sample soil. Each test chamber was capped with a screw top lid containing a hole in the center for air exchange. The ABC Laboratory control soil was an artificial soil prepared by mixing, on a dry weight basis, 10% 2.36-mm screened sphagnum peat, 20% colloidal kaolinite clay, and 70% grade 70 silica sand. The control soil and each site soil sample were hydrated to approximately 75% of water holding capacity prior to the addition of the worms. The test chambers were maintained in a temperature-controlled water bath adjusted to maintain a soil temperature of 20 ± 2 °C under continuous illumination at a light intensity between 540 and 1080 lux. Worms were not fed during the test.

The number of live and dead worms in replicates 1-10 of ABC Control and in replicates 1-5 of each site soil were enumerated at day 14 of the study. Mortality was assessed by emptying the soil onto a tray and sorting worms from the soil. Worms were considered dead if they did not

respond to a gentle touch to their anterior end. All test chambers were examined at test termination (day 28). Live and dead worms were enumerated in reps 1-10 of ABC Control and reps 1-5 of each site soil. Surviving worms were rinsed of soil, blotted dry, weighed by replicate, and placed into labeled zip lock bags, then frozen prior to being shipped to EMAX Laboratories for tissue analysis. Live worms in the remaining replicates were not weighed only frozen for tissue analysis. Worms were not purged of their gut contents prior to analysis. The criterion for test acceptability was mean survival in the controls of $\geq 90\%$. Biological test data is found in Appendix B.

2.5 Environmental Monitoring

Water bath temperatures were monitored continuously using an electronic data logging system and daily with a mercury thermometer. Soil pH was measured in each soil sample at test initiation and in one replicate of each soil sample at test termination. Environmental conditions are presented in Table 2. Soil pH was measured using a Denver Instruments pH meter. Light intensity was measured using a Li-Cor Model LI-189 light meter equipped with a photometric sensor.

Soil moisture was determined by weighing out 100 grams of the soil sample into a tared container and then re-weighing the soil after drying at approximately 100°C for at least 24 hours. The difference between the initial soil weight and the dried soil weight divided by the weight of the initial soil sample (100 grams) was the moisture content of the soil sample. The water holding capacity of the soil samples was determined by adding 100 ml of de-ionized water to the dried soil sample and then transferring the entire contents of the soil slurry into a tared funnel containing hydrated filter paper. The funnel was covered with aluminum foil and allowed to drain for a minimum of 3 hours and a maximum of 24 hours. The funnel and soil were then weighed. The water holding capacity was calculated by subtracting both the tared funnel and filter, and dry sample weights from the total weight of the funnel and soil, and then dividing by the weight of the dry sample and multiplying by 100. The result was expressed as mL of water per 100 grams of soil.

2.6 Reference Toxicant Tests

A 7-day reference toxicant test using 2-chloroacetamide was conducted on earthworms from the ABC culture. Earthworms were tested at soil concentrations of 25, 50 and 100 mg/Kg. Twenty earthworms were tested per treatment in duplicate replicates. Earthworm survival was assessed after 7 days of exposure.

2.7 Statistical Analyses

Statistical analysis was conducted on 14 and 28-day survival and replicate weight change. Statistical analysis was conducted utilizing a computerized statistical package. ABC Laboratories utilized specially written SAS programs to calculate statistically significant differences from controls and designated reference sites at the $P = 0.05$ level (3). Means comparisons were conducted on the percent survival and percent weight change data. Comparisons were made utilizing the ABC Control as well as the designated reference sites. Statistical significance for animal survival and weight change was determined by hypothesis

testing using Fisher's Exact test and Dunnett's test respectively.

3.0 RESULTS AND DISCUSSION

3.1 Survival

The study was initiated on May 19, 2003 and terminated on June 16, 2003. Survival was assessed on day 14 and 28.

Day 14 survival ranged from 0% in site samples RW0010 and RW0018 to 100% in site samples RW0001, RW0004, RW0006, RW0008ref, RW0009ref, RW0015, RW0023ref, and RW0025. There was 100% survival in the ABC control and 99% survival in the pooled reference sites. Site samples RW0001, RW0010, RW0012, RW0013, RW0018, and RW0019 were significantly reduced for survival as compared to the ABC control and the pooled reference sites. Day 14 survival is presented in Table 3.

Day 28 survival ranged from 0% in site samples RW0002, RW0010, RW0013, and RW0018 to 100% in site samples RW0006, RW0008ref, RW0009ref, RW00015, RW0023ref, and RW0025. There was 100% survival in the ABC control and 99% survival in the pooled reference sites. Site samples RW0001, RW0002, RW0005, RW0010, RW0012, RW0013, RW0017, RW0018, and RW0019 were significantly reduced for survival as compared to the ABC control and the pooled reference sites. Day 28 survival is presented in Table 4.

The survival in the ABC control and the reference sites met the criterion for a successful test.

3.2 Weight Change

All samples showed a loss in weight since no feed was added during the test (Table 5). Percent weight loss ranged from -16% in site sample RW0022 to -100% in site samples RW0002, RW0010, RW0013, and RW0018. Percent weight loss in the ABC Control was -25%. Percent weight loss in the reference sites ranged from -8% in reference site RW0007 to -23% in reference site RW0009. Site samples with statistically significant survival effects were removed from statistical analysis for weight. Site sample RW0004 was statistically reduced for percent weight loss as compared to the ABC Control. Site samples RW0007, RW0008, and RW0022 were also flagged as significantly different as compared to the ABC Control. Weight loss in these site samples was less than the control and therefore not biologically significant. Site samples RW0004 and RW0021 were significantly reduced for percent weight loss as compared to the pooled reference sites. The ABC Control was significantly reduced for percent weight loss as compared to the pooled reference site samples. Weight loss encountered in the control was typical of studies conducted at ABC where no food is added during the test.

3.3 Environmental Monitoring

Water bath and soil temperatures were maintained at 20 ± 2 °C. Daily mercury thermometer readings ranged from 19.1 to 20.6 °C. Temperature as recorded with the electronic data recording system ranged from 18.5 to 21.3 °C. Soil pH values at test initiation and termination, soil moisture content, and soil water holding capacity for all control and site soils are presented

in Table 6.

3.4 Reference Toxicant Results

After 7 days of exposure, survival was 100 % in the control 95% in the 25mg/Kg treatment. Survival was 0 % in the 50 and 100 mg/Kg treatments. The 7-day LC₅₀ for 2-chloroacetamide with *E. foetida* was 35mg/Kg and falls within the expected range of toxicity based upon historical laboratory data. Reference toxicant test data are provided in Appendix E in the form of a control chart and the statistical data for the most recent reference toxicant test.

4.0 CONCLUSIONS

The ABC control and reference site samples met the survival criterion for an acceptable study. Site samples RW0001, RW0002, RW0005, RW0010, RW0012, RW0013, RW0017, RW0018, and RW0019 were significantly reduced for 28-day survival as compared to the ABC control and the pooled reference sites. Site sample RW0004 was statistically reduced for percent weight loss as compared to the ABC Control. Site samples RW0004 and RW0021 were significantly reduced for percent weight loss as compared to the pooled reference sites. The ABC Control was significantly reduced for percent weight loss as compared to the pooled reference site samples.

5.0 REFERENCES

- (1) U.S. EPA, 1989. Protocols for Short Term Toxicity Screening of Hazardous Waste Sites. EPA/600/3-88/029.
- (2) ASTM, 1999. Conducting Laboratory Soil Toxicity or Bioaccumulation Tests with the Lumbricid Earthworm *Eisenia fetida*. Designation E-1676-95.
- (3) The SAS System for Windows, Release 6.10. Copyright 1989-1996 by SAS Institute Inc., Cary, North Carolina, 27512-8000 USA.

Table 1. Sample Receipt and Identification

Sample Name	Sample ID.	Received at ABC Labs		
		Date	Temp. (°C)	pH
HR-70Q-SS01-SS-RW0001-REG	RW0001	14-May-03	5.4	6.80
SAR-85-SS37-SS-RW0002-REG	RW0002	07-May-03	5.0	6.86
SAR-85-SS34-SS-RW0004-REG	RW0004	07-May-03	3.2	6.69
SAR-71-SS05-SS-RW0005-REG	RW0005	09-May-03	7.4	4.97
SAR-71-SS09-SS-RW0006-REG	RW0006	09-May-03	6.8	5.03
LMBC-REF1-SS-RW0007-REG	RW0007 ^a	10-May-03	2.5	5.25
LMBC-REF2-SS-RW0008-REG	RW0008 ^a	14-May-03	4.7	4.75
LMBC-REF3-SS-RW0009-REG	RW0009 ^a	14-May-03	5.5	5.45
HR-77Q-SS01-SS-RW0010-REG	RW0010	09-May-03	11.6	5.56
SAR-78-SS34-SS-RW0012-REG	RW0012	10-May-03	1.5	5.80
SAR-77-SS33-SS-RW0013-REG	RW0013	09-May-03	12.0	5.37
HR-80Q-MW02-SS-RW0014-REG	RW0014	09-May-03	12.5	5.84
SAR-77-SS50-SS-RW0015-REG	RW0015	13-May-03	1.5	5.34
MMBC-REF-SS-RW0016-REG	RW0016 ^a	13-May-03	3.0	5.16
SAR-85-SS17-SS-RW0017-REG	RW0017	14-May-03	4.9	5.73
SAR-78-SS25-SS-RW0018-REG	RW0018	13-May-03	4.3	5.79

Table 1. Cont'd Sample Receipt and Identification

Sample Name	Sample ID.	Received at ABC Labs		
		Date	Temp. (°C)	pH
SAR-78-SS17-SS-RW0019-REG	RW0019	09-May-03	13.3	5.08
SAR-69-SS11-SS-RW0021-REG	RW0021	14-May-03	1.5	5.27
SAR-85-SS02-SS-RW0022-REG	RW0022	07-May-03	3.1	6.33
HMBC-REF-SS-RW0023-REG	RW0023 ^a	10-May-03	3.0	7.42
SAR-70-SS12-SS-RW0024-REG	RW0024	09-May-03	4.8	5.41
HR-80Q-GP06-SS-RW0025-REG	RW0025	13-May-03	2.3	5.67
SAR-77-SS16-SS-RW0026-REG	RW0026	09-May-03	12.0	5.31

Note: ^a Designated reference site

Table 2. Environmental Conditions and Frequency Measured for Earthworm Tests

Environmental Condition	Frequency of Measurement (hours)	Measurement Location
Temperature	Continuously	Water Bath
Soil pH	Days 0 & 28	All Control & Site Samples
Light Intensity	Days 0 & 28	Central Water Bath
Moisture Content & Water Holding Capacity	Prior to Initiation	All Control & Site Samples

Table 3. Summary of Earthworm Test Survival Data at 14 Days

Sample ID	Day 14 Percent Survival (%)					Treatment
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	
ABC Control (Reps 1-5)	100	100	100	100	100	100
ABC Control (Reps 5-10)	100	100	100	100	100	
RW0001	100	100	100	100	100	100
RW0002	20	80	100	100	100	80 ^{1,2}
RW0004	100	100	100	100	100	100
RW0005	100	90	100	100	100	98
RW0006	100	100	100	100	100	100
RW0007ref	100	100	100	100	90	98
RW0008ref	100	100	100	100	100	100
RW0009ref	100	100	100	100	100	100
RW0010	0	0	0	0	0	0 ^{1,2}
RW0012	60	40	60	80	70	62 ^{1,2}
RW0013	40	30	20	40	50	36 ^{1,2}
RW0014	100	100	100	90	100	98
RW0015	100	100	100	100	100	100
RW0016ref	100	90	100	100	100	98
RW0017	100	100	100	80	100	96
RW0018	0	0	0	0	0	0 ^{1,2}

¹ Significant reduction in survival as compared to the ABC control ($\alpha=0.05$).

² Significant reduction in survival as compared to the pooled reference sites ($\alpha=0.05$).

Table 3. Cont'd Summary of Earthworm Test Survival Data at 14 Days

Sample ID	Day 14 Percent Survival (%)					
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Treatment
RW0019	70	50	90	50	100	73 ^{1,2}
RW0021	90	100	100	80	100	94
RW0022	100	90	100	100	100	98
RW0023ref	100	100	100	100	100	100
RW0024	90	100	100	80	90	92 ²
RW0025	100	100	100	100	100	100
RW0026	100	90	100	100	100	98

¹ Significant reduction in survival as compared to the ABC control ($\alpha=0.05$).

² Significant reduction in survival as compared to the pooled reference sites ($\alpha=0.05$).

Table 4. Summary of Earthworm Test Survival Data at 28 Days

Sample ID	Day 28 Percent Survival					
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Treatment
ABC Control (Reps 1-5)	100	100	100	100	100	100
ABC Control (Reps 1-5)	100	100	100	100	100	
RW0001	40	40	30	10	0	24 ¹
RW0002	0	0	0	0	0	0 ¹
RW0004	100	90	90	100	100	96
RW0005	80	70	90	100	70	82 ¹
RW0006	100	100	100	100	100	100
RW0007ref	100	100	100	100	90	98
RW0008ref	100	100	100	100	100	100
RW0009ref	100	100	100	100	100	100
RW0010	0	0	0	0	0	0 ¹
RW0012	0	0	0	10	0	2 ¹
RW0013	0	0	0	0	0	0 ¹
RW0014	100	100	100	90	100	98
RW0015	100	100	100	100	100	100
RW0016ref	100	90	100	100	100	98
RW0017	18	100	80	30	100	65 ¹
RW0018	0	0	0	0	0	0 ¹

¹ Significant reduction in survival as compared to the ABC control and the pooled reference sites ($\alpha=0.05$).

Table 4. Cont'd Summary of Earthworm Test Survival Data at 28 Days

Sample ID	Day 28 Percent Survival					
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Treatment
RW0019	0	0	0	0	8	2 ¹
RW0021	90	100	100	90	100	96
RW0022	100	90	100	100	91	96
RW0023ref	100	100	100	100	100	100
RW0024	90	100	100	100	100	98
RW0025	100	100	100	100	100	100
RW0026	100	90	100	100	100	98

¹ Significant reduction in survival as compared to the ABC control and the pooled reference sites ($\alpha=0.05$).

Table 5. 28-Day Earthworm Replicate Weight Change

Sample ID	Weight Change (grams)						Sample Mean	Percent Change
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5			
ABC Control Reps 1-5	-0.838	-1.068	-0.779	-0.904	-0.660	-0.989	-25 ³	
ABC Control Reps 6-10	-0.598	-1.246	-1.406	-1.269	-1.123			
RW0001	-3.111	-3.335	-2.891	-3.518	-3.959	-3.363	-87 ¹	
RW0002	--	--	--	--	--	--	-100 ¹	
RW0004	-2.117	-2.110	-1.896	-1.497	-1.865	-1.897	-49 ^{2,3}	
RW0005	-2.253	-1.974	-1.588	-1.674	-2.474	-1.933	-55 ¹	
RW0006	-0.809	-0.820	-0.843	-0.966	-0.828	-0.853	-23	
RW0007ref	-0.139	-0.124	-0.183	-0.198	-0.791	-0.287	-8	
RW0008ref	-0.428	-0.541	-0.388	-0.563	+0.031	-0.378	-10	
RW0009ref	-0.541	-0.750	-0.824	-1.275	-0.752	-0.828	-23	
RW0010	--	--	--	--	--	--	-100 ¹	
RW0012	--	--	--	-4.143	--	-3.671	-99 ¹	
RW0013	--	--	--	--	--	--	-100 ¹	
RW0014	-0.337	-0.508	-0.525	-1.241	-1.125	-0.747	-20	
RW0015	-0.911	-0.469	-0.675	-0.948	-1.102	-0.821	-22	
RW0016ref	-0.642	-0.723	-0.452	-0.777	-0.643	-0.647	-17	
RW0017	-4.245	-1.388	-1.971	-3.315	-1.741	-2.532	-67 ¹	

¹ Site samples with statistical reduction for survival removed from weight analysis

² Significant reduction in percent weight change as compared to the ABC control

³ Significant reduction in percent weight change as compared to the pooled reference sites

Table 5. Cont'd 28-Day Earthworm Replicate weights

Sample ID	Weight (grams)						
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Treatment	Percent Change
RW0018	--	--	--	--	--	--	-100 ¹
RW0019	--	--	--	--	-3.671	-3.805	-99 ¹
RW0021	-1.937	-1.219	-0.969	-1.492	-1.362	-1.396	-37 ³
RW0022	-0.773	-0.378	-0.615	-0.308	-0.981	-0.611	-16
RW0023ref	-0.692	-0.647	-0.690	-0.336	-0.574	-0.588	-16
RW0024	-0.872	-0.629	-0.848	-0.656	-0.609	-0.723	-19
RW0025	-0.318	-0.485	-0.926	-0.782	-0.773	-0.657	-18
RW0026	-0.818	-0.969	-0.388	-0.831	-0.658	-0.733	-20

¹ Site samples with statistical reduction for survival removed from weight analysis

² Significant reduction in percent weight change as compared to the ABC control

³ Significant reduction in percent weight change as compared to the pooled reference sites

Table 6. Moisture Content, Water Holding Capacity (WHC), and pH of Soils

Sample ID	Moisture Content (%)	Water Holding Capacity (mL/100 g)	pH	
			Day 0 Composite	Day 28 Replicate 1
ABC Control	1.5	61	6.03	6.21
RW0001	14.6	35	6.57	6.78
RW0002	18.2	36	6.38	6.36
RW0004	13.8	27	6.51	6.10
RW0005	22.7	48	-- ²	6.02
RW0006	20.3	47	5.22	5.65
RW0007ref	16.9	41	5.13	6.81
RW0008ref	21.5	45	4.94	5.58
RW0009ref	18.4	37	5.49	5.78
RW0010	15.5	38	5.56	-- ²
RW0012	21.4	44	5.84	6.89
RW0013	17	44	5.38	6.69
RW0014	17.3	44	5.79	7.02
RW0015	21.5	40	5.18	6.03
RW0016ref	19.3	37	4.99	5.30
RW0017	21.9	46	5.75	4.85
RW0018	9.2	16	5.86	-- ²

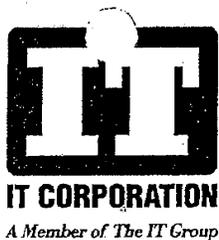
Table 6. Cont'd Moisture Content, Water Holding Capacity (WHC), and pH of Soils

Sample ID	Moisture Content (%)	Water Holding Capacity (mL/100 g)	pH	
			Day 0 Composite	Day 28 Replicate 1
RW0019	23	60	5.72	5.33
RW0021	27.8	-15 ¹	5.36	6.53
RW0022	22.7	42	5.72	5.69
RW0023ref	15.5	33	7.18	6.95
RW0024	14.8	40	5.84	5.94
RW0025	18.8	32	5.45	6.44
RW0026	16.1	41	5.37	6.67

¹ Sample was received above 100% water holding capacity and tested as received.

² pH values were inadvertently not recorded for these samples.

Appendix A
Chain-of-Custody Documentation



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: SARS85-050603-EMAX

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Project Number: 800486

Samples Shipment Date: 06 MAY 2003

Bill To: Duane Nielsen

Project Name: Fort McClellan

Lab Destination: EMAX Laboratories, Inc.

312 Directors Drive

Knoxville

TN 37923

Sample Coordinator: Oliver Allen

Lab Contact: Elizabeth McIntyre

Report To: Duane Nielsen

Turnaround Time: *Normal*

Project Contact: Tim Roth

312 Directors Drive

Knoxville

TN 37923

Carrier/Waybill No.: UPS/

Special Instructions: None	
Possible Hazard Identification: Radiological <input type="checkbox"/>	
Non-hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
Sample Disposal: Archive (mos.)	
Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/>	
1. Relinquished By (Signature/Affiliation) <i>[Signature] IT Corp</i>	Date: <i>5/6/03</i> Time: <i>1600</i>
1. Received By (Signature/Affiliation) <i>[Signature] R. Small</i>	Date: <i>MAY 7, 03</i> Time: <i>10:50 AM</i>
2. Relinquished By (Signature/Affiliation)	Date: Time:
2. Received By (Signature/Affiliation)	Date: Time:
3. Relinquished By (Signature/Affiliation)	Date: Time:
3. Received By (Signature/Affiliation)	Date: Time:
Comments: None	

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW0002	SAR-85-SS37-SS-RW0002-REG	06 MAY 2003	12:10	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0004	SAR-85-SS34-SS-RW0004-REG	06 MAY 2003	10:00	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0022	SAR-85-SS02-SS-RW0022-REG	06 MAY 2003	08:15	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	

ENVIRONMENTAL SAMPLES--CHEMISTRY ON RECEIPT

Sponsor: EMAX Labs Study No.: 48209
 Sample Type: Effluent Sediment Soil Other: _____

Data By: RW Date: Nov 07, 03

Sample ID	Temp. °C	D.O. mg/L	pH	Cond. µS/cm	Salinity ‰	Hard ^a mg/L	Alk ^a mg/L	NH ₃ ^b mg/L	Cl ₂ ^b mg/L
RW0002	5.0	-	6.86						
RW0004	3.2	-	6.69						
RW0022	3.1	-	6.33						
Device ID's	MT-11		PH-5						

^a colorimetric titration procedure adapted from APHA standard methods (mg/L as CaCO₃)
^b colorimetric method by HACH Co. for total ammonia and total chlorine



IT CORPORATION

A Member of The IT Group

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-050803-ABC2

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Project Number: 800486

Samples Shipment Date: 08 MAY 2003

Bill To: Duane Nielsen

Project Name: Fort McClellan

Lab Destination: EMAX Laboratories, Inc.

312 Directors Drive

Knoxville

TN 37923

Sample Coordinator: Oliver Allen

Lab Contact: Elizabeth McIntyre

Report To: Duane Nielsen

Turnaround Time:

Project Contact: Tim Roth

312 Directors Drive

Knoxville

TN 37923

Carrier/Waybill No.: UPS/

Special Instructions:

Possible Hazard Identification: Radiological Non-hazard Flammable Skin Irritant Poison B Unknown

Sample Disposal: Return to Client Disposal by Lab Archive (mos.)

1. Relinquished By (Signature/Affiliation) <i>D. Nielsen / SHAW</i>	Date: <i>05/08/03</i> Time: <i>1600</i>	1. Received By (Signature/Affiliation) <i>Mickey R Small</i>	Date: <i>May 9, 03</i> Time: <i>3:30 pm</i>
2. Relinquished By (Signature/Affiliation)	Date: Time:	2. Received By (Signature/Affiliation)	Date: Time:
3. Relinquished By (Signature/Affiliation)	Date: Time:	3. Received By (Signature/Affiliation)	Date: Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW0005	SAR-71-SS05-SS-RW0005-REG	08 MAY 2003	10:00	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0006	SAR-71-SS09-SS-RW0006-REG	08 MAY 2003	10:50	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0024	SAR-70-SS12-SS-RW0024-REG	08 MAY 2003	09:10	16 oz CW-JAR	3	None Required	Earthworm Survival Test - EPA 600/3-88-29	N	



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-050803-ABC

Page 1 of 1

Project Number: 800486
Project Name: Fort McClellan
Sample Coordinator: Oliver Allen
Turnaround Time:

Samples Shipment Date: 08 MAY 2003
Lab Destination: EMAX Laboratories, Inc.
Lab Contact: Elizabeth McIntyre
Project Contact: Tim Roth
Carrier/Waybill No.: UPS/

Bill To: Duane Nielsen
312 Directors Drive
Knoxville TN 37923

Report To: Duane Nielsen
312 Directors Drive
Knoxville TN 37923

Special Instructions:

Possible Hazard Identification:

Non-hazard Flammable Skin Irritant Poison B Unknown Radiological

Sample Disposal:

Return to Client Disposal by Lab Archive (mos.)

Relinquished By
(Signature/Affiliation)

DiNessel/SHAW

Date: 5/8/03
Time: 1600

1. Received By
(Signature/Affiliation)

Michael H. Small

Date: May 9, 03
Time: 3:30 pm

Relinquished By
(Signature/Affiliation)

Date:
Time:

2. Received By
(Signature/Affiliation)

Date:
Time:

Relinquished By
(Signature/Affiliation)

Date:
Time:

3. Received By
(Signature/Affiliation)

Date:
Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
010	HR-77Q-SS01-SS-RW0010-REG	07 MAY 2003	10:00	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
013	SAR-77-SS33-SS-RW0013-REG	07 MAY 2003	11:20	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
014	HR-80Q-MW02-SS-RW0014-REG	07 MAY 2003	12:30	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
019	SAR-78-SS17-SS-RW0019-REG	07 MAY 2003	08:30	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
026	SAR-77-SS16-SS-RW0026-REG	07 MAY 2003	09:15	16 oz CW-JAR	3	None Required	Earthworm Survival Test - EPA 600/3-88-29	N	

ENVIRONMENTAL SAMPLES--CHEMISTRY ON RECEIPT

Sponsor: EMAX Study No.: 48209
 Sample Type: Effluent Sediment Soil Other: _____
 Data By: RW Date: May 09, 03

Sample ID	Temp. °C	D.O. mg/L	pH	Cond. µS/cm	Salinity ‰	Hard ^a mg/L	Alk ^a mg/L	NH ₃ ^b mg/L	Cl ₂ ^b mg/L
RW0005	7.4	—	4.97	/					
RW0006	6.8	—	5.03						
RW0010	11.6	—	5.56						
RW0013	12.0	—	5.37						
RW0014	12.5	—	5.84						
RW0019	13.3	—	5.08						
RW0024	4.8	—	5.41						
RW0026	12.0	—	5.31						
Device ID's	M7-11	—	pH-5	—	—				

^a colorimetric titration procedure adapted from APHA standard methods (mg/L as CaCO₃)

^b colorimetric method by HACH Co. for total ammonia and total chlorine



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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-050903-ABC

Page 1 of 1

Project Number: 800486

Samples Shipment Date: 09 MAY 2003

Bill To: Duane Nielsen

Project Name: Fort McClellan

Lab Destination: EMAX Laboratories, Inc.

312 Directors Drive

Knoxville

TN 37923

Sample Coordinator: Oliver Allen

Lab Contact: Elizabeth McIntyre

Report To: Duane Nielsen

Turnaround Time:

NORMAL

Project Contact: Tim Roth

312 Directors Drive

Knoxville

TN 37923

Carrier/Waybill No.: UPS/

Special Instructions:	
Possible Hazard Identification: Radiological <input type="checkbox"/>	
Non-hazard <input checked="" type="checkbox"/>	Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input type="checkbox"/>
Sample Disposal: Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/> Archive (mos.)	
1. Relinquished By (Signature/Affiliation) <i>D. Nielsen/SHAW</i>	Date: <i>050903</i> Time: <i>1400</i>
1. Received By (Signature/Affiliation) <i>Stephen Bell</i>	Date: <i>May 10, 03</i> Time: <i>12:30 pm</i>
2. Relinquished By (Signature/Affiliation)	Date: Time:
2. Received By (Signature/Affiliation)	Date: Time:
3. Relinquished By (Signature/Affiliation)	Date: Time:
3. Received By (Signature/Affiliation)	Date: Time:
Comments:	

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW0007	LMBC-REF1-SS-RW0007-REG	09 MAY 2003	08:15	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0012	SAR-78-SS34-SS-RW0012-REG	09 MAY 2003	09:30	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0023	HMBC-REF-SS-RW0023-REG	09 MAY 2003	08:50	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	

ENVIRONMENTAL SAMPLES--CHEMISTRY ON RECEIPT

Sponsor: E MAX

Study No.: 48209

Sample Type: Effluent Sediment Soil

Other: _____

Data By: SB

Date: May 10, 03

Sample ID	Temp. °C	D.O. mg/L	pH	Cond. µS/cm	Salinity ‰	Hard ^a mg/L	Alk ^a mg/L	NH ₃ ^b mg/L	Cl ₂ ^b mg/L
RW0007	2.5	—	5.25	/					
RW0012	1.5	—	5.80						
RW0023	3.0	—	7.42						
Device ID's	MT-11		PH-5						

^a colorimetric titration procedure adapted from APHA standard methods (mg/L as CaCO₃)

^b colorimetric method by HACH Co. for total ammonia and total chlorine



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-051203-ABC
Page 1 of 1

Project Number: 800486
Project Name: Fort McClellan
Sample Coordinator: Oliver Allen
Turnaround Time:
NORMAL

Samples Shipment Date: 12 MAY 2003
Lab Destination: EMAX Laboratories, Inc.
Lab Contact: Elizabeth McIntyre
Project Contact: Tim Roth
Carrier/Waybill No.: UPS/

Bill To: Duane Nielsen
312 Directors Drive
Knoxville TN 37923
Report To: Duane Nielsen
312 Directors Drive
Knoxville TN 37923

Special Instructions:	
Possible Hazard Identification: Radiological <input type="checkbox"/>	
Non-hazard <input checked="" type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input type="checkbox"/>	
Sample Disposal: Archive (mos.)	
Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/>	
1. Relinquished By (Signature/Affiliation) <i>D. Nielsen/SHAAR</i>	Date: <i>05/20/03</i> Time: <i>1660</i>
2. Relinquished By (Signature/Affiliation)	Date: Time:
3. Relinquished By (Signature/Affiliation)	Date: Time:
1. Received By (Signature/Affiliation) <i>Stephen W. Bully ABC Lab</i>	Date: <i>May 13, 03</i> Time: <i>10:30A</i>
2. Received By (Signature/Affiliation)	Date: Time:
3. Received By (Signature/Affiliation)	Date: Time:
Comments:	

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW0015	SAR-77-SS50-SS-RW0015-REG	12 MAY 2003	11:55	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0016	MMBC-REF-SS-RW0016-REG	12 MAY 2003	10:45	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0018	SAR-78-SS25-SS-RW0018-REG	12 MAY 2003	09:40	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	
RW0025	HR-80Q-GP06-SS-RW0025-REG	12 MAY 2003	12:50	16 oz CW-JAR	3	None Required	Earthworm Survival Test - EPA 600/3-88-29	N	

ENVIRONMENTAL SAMPLES--CHEMISTRY ON RECEIPT

Sponsor: EMAX Labs Study No.: 48209
 Sample Type: Effluent Sediment Soil Other: _____

Data By: [Signature] Date: May 13, 03

Sample ID	Temp. °C	D.O. mg/L	pH	Cond. µS/cm	Salinity ‰	Hard ^a mg/L	Alk ^a mg/L	NH ₃ ^b mg/L	Cl ₂ ^b mg/L
RW0015	1.5	—	5.34						
RW0016	3.0	—	5.10						
RW0018	4.3	—	5.79						
RW0025	2.3	—	5.67						
Device ID's	M7-11		PH-5						

^a colorimetric titration procedure adapted from APHA standard methods (mg/L as CaCO₃)

^b colorimetric method by HACH Co. for total ammonia and total chlorine



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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-051303-ABC

Page 1 of 1

Project Number: 800486

Samples Shipment Date: 13 MAY 2003

Bill To: Duane Nielsen
312 Directors Drive
Knoxville TN 37923

Project Name: Fort McClellan

Lab Destination: EMAX Laboratories, Inc.

Report To: Duane Nielsen
312 Directors Drive
Knoxville TN 37923

Sample Coordinator: Oliver Allen

Lab Contact: Elizabeth McIntyre

Turnaround Time:

Project Contact: Tim Roth

Carrier/Waybill No.: UPS/

Special Instructions:	
Possible Hazard Identification:	
Non-hazard <input checked="" type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input type="checkbox"/>	Radiological <input type="checkbox"/>
Sample Disposal:	
Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/> Archive (mos.)	
1. Relinquished By (Signature/Affiliation) <i>D. Nielsen / SHAW</i>	Date: <i>05/30/03</i> Time: <i>1600</i>
1. Received By (Signature/Affiliation) <i>[Signature] ABC Lab</i>	Date: <i>May 14, 03</i> Time: <i>10:30am</i>
2. Relinquished By (Signature/Affiliation)	Date: Time:
2. Received By (Signature/Affiliation)	Date: Time:
3. Relinquished By (Signature/Affiliation)	Date: Time:
3. Received By (Signature/Affiliation)	Date: Time:
Comments:	

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW0001	HR-70Q-SS01-SS-RW0001-REG	13 MAY 2003	10:30	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	<i>Good</i>
RW0008	LMBC-REF2-SS-RW0008-REG	12 MAY 2003	17:10	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	<i>Good</i>
RW0009	LMBC-REF3-SS-RW0009-REG	13 MAY 2003	09:45	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	<i>Good</i>
RW0017	SAR-85-SS17-SS-RW0017-REG	13 MAY 2003	12:35	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	<i>Good</i>
RW0021	SAR-69-SS11-SS-RW0021-REG	12 MAY 2003	18:00	1 GAL P.Bucket	2	None except cool to 4 C	Earthworm Survival Test - EPA 600/3-88-29	N	<i>Good</i>

ENVIRONMENTAL SAMPLES--CHEMISTRY ON RECEIPT

Sponsor: EMAX Labs Study No.: 48209

Sample Type: Effluent Sediment Soil Other: _____

Data By: RW Date: May 14, 03

Sample ID	Temp. °C	D.O. mg/L	pH	Cond. µS/cm	Salinity ‰	Hard ^a mg/L	Alk ^a mg/L	NH ₃ ^b mg/L	Cl ₂ ^b mg/L
RW0001	5.4	-	6.80						
RW0008	4.7	-	4.75						
RW0009	5.5	-	5.45						
RW0017	4.9	-	5.73						
RW0021	1.5	-	5.27						
Device ID's	M7-11		pH-5						

^a colorimetric titration procedure adapted from APHA standard methods (mg/L as CaCO₃)
^b colorimetric method by HACH Co. for total ammonia and total chlorine

ATTACHMENT 2

**ABC Laboratory Report
BIOASSAY SAMPLE DATA FOR *Pimephales promelas*
AND *Ceriodaphnia dubia***

Study Title

Toxicity of Surface Water Samples
Collected at Fort McClellan, Alabama

Author

Ryan Warbritton
Scientist/Manager

Sponsors

Shaw Environmental, Inc.
312 Directors Drive
Knoxville, Tennessee 39723

EMAX Laboratories
1825 205th Street
Torrance, California 90501

Performing Laboratory

ABC Laboratories, Inc.
7200 E. ABC Lane
Columbia, Missouri 65202

Report Completion Date

July 25, 2003

Laboratory Project Identification

ABC Study No. 48210

Shaw Project No.: 800486

1.0 INTRODUCTION

As part of a remedial investigation at Fort McClellan, Alabama, ABC Laboratories conducted toxicity tests on water samples collected by Shaw Environmental field personnel. Waters were evaluated for effects on the survival and growth of fathead minnows, *Pimephales promelas* and for the effects of survival and reproduction with the freshwater cladoceran, *Ceriodaphnia dubia*.

2.0 MATERIALS AND METHODS

2.1 Site and Reference Water Samples

Site water samples were received at ABC Laboratories in two shipments. Sample receipt dates were June 11 and 12, 2003. The first shipment was sent in duplicate one-gallon polyethylene containers. All shipments were received as quadruplicate gallon containers packed on ice. Water samples were logged in and a sub-sample was then removed for on-arrival water chemistry. The remaining water was refrigerated at approximately 4°C until used during subsequent days. Chain-of-custody documentation is presented in Appendix A. Sample name, sample ID, and the date received are presented in Table 1.

2.2 Test Organisms

Fathead minnows, *Pimephales promelas*, ≤24 hours post hatch were utilized for testing. All broodstock spawned to generate these larval fish were obtained from in-house cultures maintained at ABC Laboratories.

The *Ceriodaphnia dubia* utilized for testing were ≤24 hours old and from cultures maintained at ABC Laboratories.

2.3 Test Procedures

2.3.1 General

All site samples were tested in conjunction with one site-specific reference sample (sample designation REFST-SW-RW2012-REG) and an ABC control. Test results for all site samples were compared statistically to the reference site and to the ABC control data. The test procedures utilized in the performance of the 7-day fathead minnow and *Ceriodaphnia dubia* toxicity tests were based upon those procedures described in "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (1). The test chambers were maintained in a temperature-controlled water bath adjusted to maintain a water temperature of $25 \pm 1^\circ\text{C}$. The water bath was illuminated with ambient laboratory lighting set with a 16:8, light:dark cycle with a thirty minute dawn/dusk transition periods. Water samples were removed from the cooler each morning and placed into a water bath to warm them to testing temperature prior to use. Single bubble aeration was provided at this time via a small bore pipet to ensure proper oxygen levels during water renewal. The ABC Laboratory control water utilized for testing was laboratory freshwater. This water was prepared from well water, which was obtained from an approximately 1000-ft

deep well. Water is pumped out of the well through an air stripper to volatilize possible contaminants and to bring gasses into equilibrium. A portion of the well water was pumped through reverse osmosis (RO) units for de-mineralization. This RO water was blended back with well water until the desired chemistry (hardness) was achieved. Each replicate was renewed daily with sample or control water.

2.3.2 Fathead Minnow

Each site sample was replicated four times with 10 fathead minnows per replicate chamber. Minnows were fed *ad libitum* three times daily with newly hatched brine shrimp (*Artemia* sp.) and supplemented the first two days with rotifers (*Brachionus plicatilis*). Care was taken not to over feed so that dissolved oxygen and pH levels were unaffected. Test chambers were 1-L glass jars containing approximately 500-mL of water. Renewals were accomplished by removing 95% or more of the water and as much of the feces and uneaten food as possible, with a large bore pipet. Water chemistry was measured for one replicate of new and old solutions prior to conducting the daily renewals. Survival was recorded daily for each replicate. All samples were monitored for 7 days. At the end of the seven days the surviving fish were anesthetized, placed into pre weighed aluminum containers, and blotted dry. They were then dried for up to 24 hours at 80-100°C, cooled to room temperature in a dessicator, re-weighed, and total dry weights recorded. Average dry weights per organism were determined for statistical comparisons. The criterion for test acceptability was mean survival of $\geq 80\%$ and a mean dry weight of $\geq 0.25\text{mg/fish}$ in the controls. Fathead minnow test data are presented in Appendix B.

2.3.3 *Ceriodaphnia dubia*

Tests were conducted in 50-mL beakers each containing ~25 mL of test solution. Each site sample was replicated 10 times and the ABC control was replicated 20 times. An extra replicate of ~200 mL was utilized for daily water chemistry. At test initiation, one *Ceriodaphnia dubia* neonate (less than 24 hours old) was added to each of the 10 replicate beakers per control and test sample. All beakers were monitored daily for survival of *C. dubia* and the production of young. Test solutions were renewed daily. New solution volumes of ~25 mL and approximately 0.2-0.4 mL of a mixture of live algae (*Selenastrum* sp. and *Ankistrodesmus* sp.) and *Daphnia* feeding supplement were added to beakers and placed in the water bath to equilibrate to test temperature prior to transferring adults into the new solutions. The criterion for test acceptability was mean survival of $\geq 80\%$ in the control(s), an average of 15 or more young per surviving female in the control solutions, and production of at least three broods in 60% of the surviving control organisms. *Ceriodaphnia dubia* test data are presented in Appendix C.

2.4 Environmental Monitoring

Routine environmental conditions monitored during the Fathead minnow and *Ceriodaphnia dubia* tests are summarized in Table 2. Water bath temperatures were monitored continuously using an electronic data logging system. Solution temperatures were measured using a mercury thermometer, or one of the meters calibrated for temperature. Daily dissolved oxygen (DO) and

pH measurements were collected from the new solutions prior to renewal. Temperature, DO, and pH were measured daily from the old solutions. Each set of samples was measured on arrival for temperature, DO, pH, conductivity, alkalinity, hardness, and total ammonia. Dissolved oxygen was measured with a WTW Oxi 330 dissolved oxygen meter, pH with a Denver instruments pH meter, and conductivity with an Orion Model 140 conductivity and salinity meter. Temperature, DO, pH, and conductivity were all measured according to methods described by the manufacturer as written in internal standard operating procedures (SOP's). Hardness and alkalinity were measured utilizing methods from HACH Company, Loveland, Colorado (2 and 3).

2.5 Statistical Analyses

Statistical significance for fathead minnow survival and dry weights and *Ceriodaphnia dubia* survival and reproduction was determined by hypothesis testing. Statistical analysis was performed using a custom computer program, ToxCalc (4). This program is designed to calculate the desired statistic and its 95% confidence interval (C.I.), as applicable, using the appropriate United States Environmental Protection Agency (US EPA) recommended analysis.

Generally, the statistical approach was as follows. Analyses of each endpoint between samples was evaluated by first analyzing the data for normality and homogeneity of variances with either Shapiro-Wilk's Test, Bartlett's, or Kolmogorov D Test before comparison of means. If the data were normally distributed and the variances were homogeneous, then analysis of variances (ANOVA) was utilized for the weight data along with Dunnett's procedure for comparing the means. Survival data were analyzed using Fisher's Exact test. If the assumptions of normality or homogeneity of variance were not met, transformations of the survival data were employed to allow the use of parametric procedures. If transformations (e.g., arc sine-square root transformation) of the survival data still did not meet assumptions of normality and homogeneity, then a non-parametric test, Steel's Many-One Rank Test, Bonferroni t Test, or Wilcoxon Rank Sum Test, was used to analyze these data. All means comparisons analyses were performed at an α level of 0.05.

3.0 RESULTS AND DISCUSSION

3.1 Fathead Minnows

3.1.1 Survival

Survival percentages of fathead minnows for all replicate test chambers are presented in Table 3. Survival percentages ranged from 78% in sample RW2005 to 100% in sample RW2011. Survival in the reference site (RW2012ref) and the ABC control was 98% and 99%, respectively. There was no significant difference in the survival of the ABC control and the reference site. There were no site samples with a statistical reduction of survival as compared to the ABC control. Site sample RW2005 was statistically reduced for survival as compared to the reference site RW2012ref.

3.1.2 Dry Weight

Dry weight data for all replicate test chambers are presented in Table 4. Mean dry weights per fish ranged from 0.0004 grams in sample RW2002 to 0.0011 grams in sample RW2006. The mean dry weight of the ABC control was 0.0010 grams and the reference site RW2012ref was 0.0011 grams. There was no significant difference between the control and reference site. Site samples RW2001, RW2002, RW2004, RW2005, and RW2007 were statistically reduced for growth as compared to both the ABC control and the reference site.

3.1.3 Environmental Parameters

The continuously recorded water bath temperatures ranged from 18.7 to 25.5 °C with a mean temperature of 25.2 °C during the 7-day exposure. The low value was the result of the probe being briefly removed from the water bath during one of the daily water changes. Water bath temperature ranged from 25.3 to 25.4 °C as recorded daily with a mercury thermometer. Old solution water temperatures ranged from 24.4 to 25.1 °C. Dissolved oxygen levels ranged from 5.3 to 7.6 mg/L and pH levels ranged from 6.80 to 8.42. Water quality ranges are presented in Table 5. All fathead minnow raw data measurements can be found in Appendix B.

3.2 *Ceriodaphnia dubia*

3.2.1 Survival

Survival percentages of *Ceriodaphnia dubia* for all replicate test chambers are presented in Table 6. Survival percentages ranged from 0% in samples RW2001, RW2002, RW2004, RW2005, and RW2007 to 100% in sample RW2008. Survival in the reference site, RW2012ref was 80% and the ABC control was 95%. There was no significant difference in the survival of the ABC control and the reference site. Site samples RW2001, RW2002, RW2004, RW2005, RW2007, RW2010, and RW2011 were significantly reduced ($\alpha=0.05$) for survival as compared to both the ABC control and the reference site.

3.2.2 Reproduction

Mean reproduction data for all replicate test chambers are presented in Table 7. Reproduction ranged from 0 in samples RW2001, RW2002, RW2004, RW2005, and RW2007 (0% survival) to 53.0 neonates in sample RW2008. Mean reproduction of the ABC control and reference sample were 58.6 and 30.4 neonates, respectively. The reference site mean reproduction was significantly reduced ($\alpha=0.05$) as compared to the control. With site samples removed from analysis that were impacted for survival, site samples RW2006 and RW2009 were significantly reduced as compared to the ABC control for neonate production. There was no significant reduction for reproduction for the site samples not impacted for survival as compared to the reference site.

3.2.3 Environmental Parameters

The continuously recorded water bath temperatures ranged from 24.8 to 25.9°C with a mean temperature of 25.1°C during the 7-day exposure. Water bath temperature ranged from 25.1 to 25.7°C as recorded daily with a mercury thermometer. Old solution water temperatures ranged from 24.4 to 25.1°C. DO levels ranged from 6.9 to 8.0mg/L and pH levels ranged from 6.87 to 8.55. Water quality ranges are presented in Table 8. All *Ceriodaphnia dubia* raw data measurements can be found in Appendix C.

4.0 CONCLUSIONS

4.1 Fathead Minnows

The ABC control met or exceeded the criteria necessary for study acceptability for both survival and dry weight. No significant statistical differences occurred between the ABC control and the site samples for survival. Site sample RW2005 was statistically reduced for survival as compared to the reference site. Site samples RW2001, RW2002, RW2004, RW2005, and RW2007 were statistically reduced for growth as compared to both the ABC control and the reference site.

4.2 *Ceriodaphnia dubia*

The ABC control met or exceeded the criteria necessary for study acceptability for both survival and reproduction. Site samples RW2001, RW2002, RW2004, RW2005, RW2007, RW2010, and RW2011 were significantly reduced for survival as compared to both the ABC control and the reference site. Site samples RW2006 and RW2009 were significantly reduced as compared to the ABC control for neonate production. There was no significant reduction for reproduction as compared to the reference site. There was no significant difference between the ABC control and the reference site for survival but the reference site was significantly reduced in regard to reproduction.

5.0 REFERENCES

1. U.S. EPA, 2002. Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms. EPA/821/R-02/013
2. HACH Company. 1997. Method 8226, Total Hardness. IN Water Analysis Handbook. HACH Company, Loveland, Colorado. Pages 601-607.
3. HACH Company. 1997. Method 8221, Alkalinity. IN Water Analysis Handbook. HACH Company, Loveland, Colorado. Pages 181-187.
4. ToxCalc™ Version 5.0, Release 6.12. Copyright 1994 by Tidepool Scientific Software: Michael A. Ives.

Table 1. Sample ID and Date Received

Sample Name	Sample ID	Date Received
SAR-85-SW/SD05-SW-RW2001-REG	RW2001	June 11, 2003
SAR-85-SW/SD07-SW-RW2002-REG	RW2002	June 11, 2003
SAR-78-SW/SD12-SW-RW2004-REG	RW2004	June 12, 2003
SAR-85-SW/SD08-SW-RW2005-REG	RW2005	June 11, 2003
SAR-78-SW/SD13-SW-RW2006-REG	RW2006	June 12, 2003
HR-85Q-SW/SD02-SW-RW2007-REG	RW2007	June 12, 2003
SAR-77-SW/SD15-SW-RW2008-REG	RW2008	June 12, 2003
SAR-78-SW/SD14-SW-RW2009-REG	RW2009	June 12, 2003
SAR-77-SW/SD19-SW-RW2010-REG	RW2010	June 12, 2003
SAR-77-SW/SD20-SW-RW2011-REG	RW2011	June 12, 2003
REFST-SW-RW2012-REG	RW2012 Ref	June 12, 2003

Table 2. Routine Environmental Conditions and Frequency Measured

Environmental Condition	Frequency of Measurement (hours)	Measurement Location
Temperature	Continuously	Water Bath
Solution Temperature	Daily	All Control & Site Samples Both New and Old Solutions
Dissolved Oxygen	Daily	All Control & Site Samples Both New and Old Solutions
pH	Initiation and Termination	All Control & Site Samples
Conductivity	Initiation and Termination	All Control & Site Samples
Hardness	On Arrival	NA
Alkalinity	On Arrival	NA
Total Ammonia	On Arrival	NA

Table 3. Summary of Fathead Minnow Test Survival Data

Sample ID	Survival (%)				
	Rep 1	Rep 2	Rep 3	Rep 4	Sample
ABC (Reps 1-4)	100	90	100	100	99
ABC (Reps 5-8)	100	100	100	100	
RW2001	80	90	90	100	90
RW2002	91	80	90	80	85
RW2004	80	100	90	100	93
RW2005	100	60	80	70	78 ^a
RW2006	80	100	100	100	95
RW2007	80	100	100	90	93
RW2008	100	100	100	90	98
RW2009	90	100	100	100	98
RW2010	90	70	100	80	85
RW2011	100	100	100	100	100
RW2012 Ref	100	100	100	90	98

^a No statistically significant mortality occurred as compared to the ABC control ($\alpha=0.05$). Site Sample RW2005 survival was significantly reduced as compared to the reference site RW2012ref.

Table 4. Summary of Fathead Minnow Test Dry Weight Data

Sample ID	Mean Dry Weight (grams)				
	Rep 1	Rep 2	Rep 3	Rep 4	Sample
ABC (Reps 1-4)	0.0009	0.0009	0.0009	0.0009	0.0010
ABC (Reps 5-8)	0.0011	0.0010	0.0010	0.0010	
RW2001	0.0009	0.0007	0.0005	0.0005	0.0006 ^a
RW2002	0.0005	0.0002	0.0003	0.0004	0.0004 ^a
RW2004	0.0006	0.0006	0.0005	0.0005	0.0005 ^a
RW2005	0.0004	0.0006	0.0006	0.0004	0.0005 ^a
RW2006	0.0011	0.0011	0.0012	0.0010	0.0011
RW2007	0.0006	0.0009	0.0007	0.0007	0.0007 ^a
RW2008	0.0008	0.0011	0.0010	0.0008	0.0010
RW2009	0.0010	0.0008	0.0010	0.0011	0.0010
RW2010	0.0010	0.0007	0.0008	0.0011	0.0009
RW2011	0.0010	0.0009	0.0010	0.0007	0.0009
RW2012 Ref	0.0011	0.0010	0.0010	0.0011	0.0011

^a Statistically significant difference in dry weight as compared to the ABC control and the RW2012 Reference site ($\alpha=0.05$).

Table 5. Summary of Water Quality Ranges for the Fathead Minnow Test

Sample ID	Water Quality Ranges ^a		
	Temperature °C	Dissolved Oxygen mg/L	pH
ABC	24.5 – 24.8	6.4 – 7.5	7.98 – 8.42
RW2001	24.5 – 25.0	6.4 – 7.6	7.08 – 7.60
RW2002	24.6 – 25.0	6.2 – 7.4	7.02 – 7.41
RW2004	24.6 – 25.0	6.1 – 7.5	7.00 – 7.39
RW2005	24.6 – 25.0	6.2 – 7.1	6.96 – 7.35
RW2006	24.6 – 25.0	6.0 – 7.0	6.92 – 7.26
RW2007	24.7 – 25.0	6.0 – 7.2	6.91 – 7.22
RW2008	24.6 – 25.0	6.0 – 7.4	6.91 – 7.18
RW2009	24.6 – 25.0	5.9 – 7.5	6.87 – 7.16
RW2010	24.6 – 24.9	5.7 – 7.5	6.84 – 7.17
RW2011	24.5 – 24.9	5.6 – 7.5	6.80 – 7.11
RW2012 Ref	24.3 – 25.0	5.3 – 7.6	6.80 – 7.10

^a Old solution water chemistry

Table 6. Summary of *Ceriodaphnia dubia* Test Survival Data

Sample ID	Replicate Percent Survival										Treatment
	1	2	3	4	5	6	7	8	9	10	
ABC (Rep 1-10)	100	100	100	100	100	100	100	100	100	100	95
ABC (Rep 11-20)	100	100	100	100	100	0	100	100	100	100	
RW2001	0	0	0	0	0	0	0	0	0	0	0 ^a
RW2002	0	0	0	0	0	0	0	0	0	0	0 ^a
RW2004	0	0	0	0	0	0	0	0	0	0	0 ^a
RW2005	0	0	0	0	0	0	0	0	0	0	0 ^a
RW2006	100	100	100	100	100	100	0	100	100	100	90
RW2007	0	0	0	0	0	0	0	0	0	0	0 ^a
RW2008	100	100	100	100	100	100	100	100	100	100	100
RW2009	100	100	100	100	0	100	100	100	100	100	90
RW2010	0	100	0	100	100	0	0	100	0	0	40 ^a
RW2011	0	0	0	0	100	0	100	100	100	100	50 ^a
RW2012 Ref	100	100	0	100	100	100	100	100	100	0	80

^a Statistically significant difference in survival as compared to the ABC control and the RW2012 Reference site ($\alpha=0.05$).

Table 7. Summary of *Ceriodaphnia dubia* Test Reproduction Data

Sample ID	Replicate Number of Young/Adult										Treatment Total	Treatment Mean
	1	2	3	4	5	6	7	8	9	10		
ABC (Rep 1-10)	48	64	64	67	68	68	66	69	40	41	1,171	58.6
ABC (Rep 11-20)	51	66	72	60	58	0	80	63	71	55		
RW2001	0	0	0	0	0	0	0	0	0	0	0	0 ^c
RW2002	0	0	0	0	0	0	0	0	0	0	0	0 ^c
RW2004	0	0	0	0	0	0	0	0	0	0	0	0 ^c
RW2005	0	0	0	0	0	0	0	0	0	0	0	0 ^c
RW2006	35	58	53	38	59	50	44	59	51	20	467	46.7 ^{a,b}
RW2007	0	0	0	0	0	0	0	0	0	0	0	0 ^c
RW2008	38	56	64	53	40	45	58	53	62	61	530	53.0 ^b
RW2009	32	40	37	56	0	37	52	62	52	51	419	41.9 ^{a,b}
RW2010	30	19	29	18	45	29	6	48	28	11	263	26.3 ^c
RW2011	9	20	26	18	31	14	46	29	13	21	227	22.7 ^c
RW2012 Ref	38	38	0	33	34	39	37	44	46	0	304	30.4 ^a

^a Statistically significant reduction in reproduction as compared to the ABC control ($\alpha=0.05$).

^b There was no statistically significant reduction in reproduction as compared to the RW2012 reference site ($\alpha=0.05$).

^c Statistically reduced for survival and not included in statistical analysis for reproduction.

Table 8. Summary of Water Quality Ranges for the *Ceriodaphnia dubia* Test

Sample ID	Water Quality Ranges ^a		
	Temperature °C	Dissolved Oxygen mg/L	pH
ABC	24.4 – 24.8	7.1 – 7.9	8.43 – 8.55
RW2001	24.7 – 25.0	7.0 – 8.0	7.31 – 7.84
RW2002	24.8 – 25.1	7.0 – 8.0	7.24 – 7.49
RW2004	24.9 – 25.1	7.0 – 7.9	7.15 – 7.35
RW2005	24.8 – 25.1	7.0 – 8.0	7.12 – 7.20
RW2006	24.7 – 25.1	7.0 – 7.9	7.11 – 7.78
RW2007	24.9 – 25.1	6.9 – 7.9	7.09 – 7.10
RW2008	24.7 – 25.1	7.0 – 8.0	7.07 – 7.65
RW2009	24.8 – 25.1	7.0 – 7.9	7.00 – 7.59
RW2010	24.8 – 25.1	6.9 – 7.9	6.94 – 7.59
RW2011	24.8 – 25.1	6.9 – 7.9	6.89 – 7.53
RW2012 Ref	24.8 – 25.1	6.9 – 7.9	6.87 – 7.44

^a Old solution water chemistry

Appendix A

Chain-of-Custody Documentation



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-061103-ABC
Page 1 of 2

Project Number: 800486 Samples Shipment Date: 11 JUN 2003
Project Name: Fort McClellan Lab Destination: ABC Laboratories
Sample Coordinator: *Oliver Allen Sr. & Hague* Lab Contact: Mickey Kernodle
Turnaround Time: *Normal* Project Contact: Tim Roth
Carrier/Waybill No.: UPS/

Bill To: Duane Nielsen
312 Directors Drive
Knoxville TN 37923
Report To: Duane Nielsen
312 Directors Drive
Knoxville TN 37923

Special Instructions: None	
Possible Hazard Identification: Radiological <input type="checkbox"/>	
Non-hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
Sample Disposal: Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/> Archive (mos.)	
1. Relinquished By (Signature/Affiliation) <i>[Signature]</i> <i>Shaw ECI</i>	Date: <i>6/11/03</i> Time: <i>1800</i>
2. Relinquished By (Signature/Affiliation)	Date: Time:
3. Relinquished By (Signature/Affiliation)	Date: Time:
1. Received By (Signature/Affiliation) <i>[Signature]</i> <i>ABC Labs</i>	Date: <i>June 12, 2003</i> Time: <i>10:30 am</i>
2. Received By (Signature/Affiliation)	Date: Time:
3. Received By (Signature/Affiliation)	Date: Time:
Comments: None	

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW2004	SAR-78-SW/SD12-SW-RW2004-REG	10 JUN 2003	15:00	1 GAL CUBE	1	None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	<i>good</i>
RW2004	SAR-78-SW/SD12-SW-RW2004-REG	10 JUN 2003	15:00	1 GAL CUBE	2	None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	<i>good</i>
RW2006	SAR-78-SW/SD13-SW-RW2006-REG	10 JUN 2003	15:50	1 GAL CUBE	1	None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	<i>good</i>
RW2006	SAR-78-SW/SD13-SW-RW2006-REG	10 JUN 2003	15:50	1 GAL CUBE	2	None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	<i>good</i>
RW2007	HR-85Q-SW/SD02-SW-RW2007-REG	10 JUN 2003	14:00	1 GAL CUBE	1	None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	<i>good</i>
RW2007	HR-85Q-SW/SD02-SW-RW2007-REG	10 JUN 2003	14:00	1 GAL CUBE	2	None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	<i>good</i>



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-061103-ABC

Page 2 of 2

Sample No	Sample Name	Sample Date	Sample Time	Container	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW2008	SAR-77-SW/SD15-SW-RW2008-REG	11 JUN 2003	08:50	1 GAL CUBE	1 None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	Good
RW2008	SAR-77-SW/SD15-SW-RW2008-REG	11 JUN 2003	08:50	1 GAL CUBE	2 None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	Good
RW2009	SAR-78-SW/SD14-SW-RW2009-REG	11 JUN 2003	08:15	1 GAL CUBE	2 None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	Good
RW2009	SAR-78-SW/SD14-SW-RW2009-REG	11 JUN 2003	08:15	1 GAL CUBE	1 None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	Good
RW2010	SAR-77-SW/SD19-SW-RW2010-REG	11 JUN 2003	09:30	1 GAL CUBE	1 None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	Good
RW2010	SAR-77-SW/SD19-SW-RW2010-REG	11 JUN 2003	09:30	1 GAL CUBE	2 None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	Good
RW2011	SAR-77-SW/SD20-SW-RW2011-REG	11 JUN 2003	10:15	1 GAL CUBE	1 None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	Good
RW2011	SAR-77-SW/SD20-SW-RW2011-REG	11 JUN 2003	10:15	1 GAL CUBE	2 None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	Good
RW2012	REFST-SW-RW2012-REG	11 JUN 2003	11:15	1 GAL CUBE	1 None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	Good
RW2012	REFST-SW-RW2012-REG	11 JUN 2003	11:15	1 GAL CUBE	2 None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	Good

Did not receive RW 2003 today 9:40 June 12, 03



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-061003-ABC
Page 1 of 2

Project Number: 800486 Samples Shipment Date: 10 JUN 2003
 Project Name: Fort McClellan Lab Destination: ABC Laboratories
 Sample Coordinator: *Oliver Allen Ke. R. Hogue* Lab Contact: Mickey Kernodle
 Turnaround Time: *Normal* Project Contact: Tim Roth
 Carrier/Waybill No.: UPS/

Bill To: Duane Nielsen
 312 Directors Drive
 Knoxville TN 37923
 Report To: Duane Nielsen
 312 Directors Drive
 Knoxville TN 37923

Special Instructions: None

Possible Hazard Identification: Radiological Non-hazard Flammable Skin Irritant Poison B Unknown

Sample Disposal: Return to Client Disposal by Lab Archive (mos.)

1. Relinquished By (Signature/Affiliation) <i>Ke. R. Hogue - Shaw E&E</i> Date: <i>6/10/03</i> Time: <i>18:00</i>	1. Received By (Signature/Affiliation) <i>Tim Roth ABC LABS</i> Date: <i>Jun 11, 03</i> Time: <i>~10:30am</i>
2. Relinquished By (Signature/Affiliation) Date: Time:	2. Received By (Signature/Affiliation) Date: Time:
3. Relinquished By (Signature/Affiliation) Date: Time:	3. Received By (Signature/Affiliation) Date: Time:

Comments: None

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW2001	SAR-85-SW/SD05-SW-RW2001-REG	10 JUN 2003	09:00	1 GAL CUBE	1	None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	<i>good</i>
RW2001	SAR-85-SW/SD05-SW-RW2001-REG	10 JUN 2003	09:00	1 GAL CUBE	2	None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	<i>good</i>
RW2002	SAR-85-SW/SD07-SW-RW2002-REG	10 JUN 2003	10:00	1 GAL CUBE	1	None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	<i>good</i>
RW2002	SAR-85-SW/SD07-SW-RW2002-REG	10 JUN 2003	10:00	1 GAL CUBE	2	None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	<i>good</i>
RW2003	SAR-85-SW/SD07-SW-RW2003-FD	10 JUN 2003	10:00	1 GAL CUBE	1	None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N	<i>Did NOT Receive</i>
RW2003	SAR-85-SW/SD07-SW-RW2003-FD	10 JUN 2003	10:00	1 GAL CUBE	2	None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N	<i>Did NOT Receive</i>



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-061003-ABC

Page 2 of 2

Sample No	Sample Name	Sample Date	Sample Time	Container	Preservative	Requested Testing Program	Flt	CID	Condition On Receipt
RW2005	SAR-85-SW/SD08-SW-RW2005-REG	10 JUN 2003	11:15	1 GAL CUBE	1 None except cool to 4 C	Ceriodaphnia Dubia Survival and Growth Test - EPA 1002.0	N		<i>Good</i>
RW2005	SAR-85-SW/SD08-SW-RW2005-REG	10 JUN 2003	11:15	1 GAL CUBE	2 None except cool to 4 C	Pimephales Larval Test - EPA 1000.0	N		<i>Good</i>

ENVIRONMENTAL SAMPLE RECEIPT

Data by: MC Date: June 12, 03 Study No.: 48210

Sponsor: E-Max Lab Contact: Elizabeth McIntyre

Sample Type/ID
 Effluent ID(s) _____ Receiving Water ID _____
 Sediment ID(s) _____ Soil ID _____
 Other ID Surface Water

Number of containers 16 Total / 4 each Mass/Volume each 1 gal

Comments/Sample Description
 SAR-78 - SW14 = RW2009
 SAR-77 - SW19 = RW2010
 SAR-77 - SW20 = RW2011
 REFST - SW-RW ~~2012~~ 2012 = RW2012

STORAGE
 Used immediately upon receipt
 Stored at -4°C Cooler ID _____ R-1 R-2 Other _____

CHEMISTRY ON RECEIPT

Sample ID	Temp ^a (°C)	DO (mg/L)	pH	Cond. (µS/cm)	Hard ^{b,c} (mg/L)	Alk ^{b,c} (mg/L)	NH ₃ ^d (mg/L)	Cl ₂ ^d (mg/L)
RW2009	1.3	11.6	6.43	17.96	0.4	0.3	0.6	0.0
RW2010	1.5	11.5	6.90	14.90	0.2	0.2	0.6	0.0
RW2011	1.6	11.2	6.47	14.36	0.2	0.3	0.6	0.0
RW2012	1.6	11.7	6.29	15.43	0.2	0.3	0.6	0.0
Device ID	MT-11	DO-8	PH-6	CM-1				

^a Correction factor _____ °C @ _____ °C
^b Colorimetric titration procedure adapted from APHA Standard Methods (mg/L as CaCO₃)
^c 1st number is mL of titrant second number is mg/L hardness
^d Colorimetric method by HACH Co. for total ammonia and total chlorine

Ⓞ R SB June 12, 03

ENVIRONMENTAL SAMPLE RECEIPT

Data by: AW/MC/SB Date: June 12, 03 Study No.: 48210

Sponsor: E-Max Lab Contact: Elizabeth

Sample Type/ID
 Effluent ID(s) _____ Receiving Water ID _____
 Sediment ID(s) _____ Soil ID _____
 Other ID Surface Water

Number of containers 16 Total / 4 each Mass/Volume each 1 gal

Comments/Sample Description
 SAR-78-SW12 = RW2004
 SAR-78-SW13 = RW2006
 SAR-77-SW15 = RW2008
 HR-85QSW02 = RW2007

STORAGE
 Used immediately upon receipt
 Stored at ~4°C Cooler ID _____ R-1 R-2 Other _____

CHEMISTRY ON RECEIPT

Sample ID	Temp ^a (°C)	DO (mg/L)	pH	Cond. (µS/cm)	Hard ^{b,c} (mg/L)	Alk ^{b,c} (mg/L)	NH ₃ ^d (mg/L)	Cl ₂ ^d (mg/L)
RW2004	1.5	10.6	6.84	20.8	0.3	0.4	0.6	0.0
RW2006	1.0	11.0	6.97	18.32	0.3	0.3	0.6	0.0
RW2007	1.4	11.8	6.53	20.1	0.5	0.4	0.6	0.0
RW2008	1.3	11.5	6.56	18.41	0.5	0.3	0.6	0.0
Device ID	MT-11	DO-8	PH-6	CM-1				

^a Correction factor _____ °C @ _____ °C
^b Colorimetric titration procedure adapted from APHA Standard Methods (mg/L as CaCO₃)
^c 1st number is mL of titrant second number is mg/L hardness
^d Colorimetric method by HACH Co. for total ammonia and total chlorine

ENVIRONMENTAL SAMPLE RECEIPT

Data by: SD / PW Date: June 11, 03 Study No.: 48210

Sponsor: E-Max Lab Contact: Elizabeth McIntyre

Sample Type/ID

- Effluent ID(s) _____ Receiving Water ID _____
 Sediment ID(s) _____ Soil ID _____
 Other ID Surface Water

Number of containers 12 Total / 4 each Mass/Volume each 1gal

Comments/Sample Description

SAR-85-SW05 = RW2001
SAR-85-SW07 = RW2002
SAR-85-SW08 = RW2005

STORAGE

- Used immediately upon receipt
 Stored at -4°C Cooler ID _____ R-1 R-2 Other _____

CHEMISTRY ON RECEIPT

Sample ID	Temp ^a (°C)	DO (mg/L)	pH	Cond. (µS/cm)	Hard ^{b,c} (mg/L)	Alk ^{b,c} (mg/L)	NH ₃ ^d (mg/L)	Cl ₂ ^d (mg/L)
RW2001	2.8	10.6	7.30	19.48	0.3	0.3	0.3	0.0
RW2002	1.9	11.5	7.03	20.2	0.3	0.4	0.5	0.0
RW2005	2.5	11.3	6.84	20.2	0.4	0.4	0.6	0.0
Device ID	MT-11	DO-8	PH-6	CM-1				

^a Correction factor _____ °C@ _____ °C

^b Colorimetric titration procedure adapted from APHA Standard Methods (mg/L as CaCO₃)

^c 1st number is mL of titrant second number is mg/L hardness

^d Colorimetric method by HACH Co. for total ammonia and total chlorine

ATTACHMENT 3

**ABC LABORATORY REPORT
BIOASSAY SAMPLE DATA FOR *Chironomus riparius***

Study Title

10-Day Survival, Growth, and Bioaccumulation of *Chironomus riparius*
With Sediment Samples Collected at Fort McClellan, Alabama

Author

Ryan Warbritton
Scientist/Manager

Sponsor

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312 Directors Drive
Knoxville, Tennessee 39723

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Torrance, California 90501

Performing Laboratory

ABC Laboratories, Inc.
Chemical Development Group
7200 E. ABC Lane
Columbia, Missouri 65202

Report Completion Date

August 06, 2003

Laboratory Project Identification

ABC Study No. 48235

Shaw Project No.: 800486

1.0 INTRODUCTION

As part of a remedial investigation at the Fort McClellan, Alabama, ABC Laboratories conducted toxicity tests on sediment samples collected by Shaw Environmental field personnel. All sediments were evaluated for effects on survival, growth, and bioaccumulation for the midge, *Chironomus riparius*.

2.0 MATERIALS AND METHODS

2.1 Sediment Samples

Sediment samples were received at ABC Laboratories in two shipments that arrived June 18 and 19, 2003. Sediment samples were received in 3.8-liter polypropylene containers and the containers were packed in ice. All samples were received in good shape. Sediment samples were logged in and then refrigerated at approximately 4 °C until use. Chain-of-custody documentation is presented in Appendix A. Sample receipt and identification is presented in Table 1. Site sample RW012ref was designated as the reference site.

2.2 Test Organisms

Larval midge (*Chironomus riparius*) were obtained from ABC in-house cultures. Animals utilized for the study were 1-3 days old post hatch.

2.3 Test Procedures

2.3.1 10-Day Survival and Growth

The test procedures utilized in the performance of the 10-day midge toxicity tests were based upon those procedures described in "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Fresh water Invertebrates" (1) and "Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates" (2). The ABC control was replicated 16 times and site sediment samples for all screening toxicity tests were replicated eight times with 10 organisms per replicate chamber. The test chambers were approximately 0.5-L glass jars containing approximately ~100ml of sediment and approximately 400mL of overlying water. The overlying water was laboratory freshwater prepared by blending well water with well water treated by reverse-osmosis to produce water with a hardness of 160 to 180 mg/L as CaCO₃. The overlying water was renewed using an automated system that provided approximately two volume additions per day per replicate chamber. Each test chamber was fitted with a screened collar to allow water to drain from the chamber while retaining the test organisms. The ABC Laboratory control sediment was natural sediment collected from a small pond on the property of ABC Laboratories. This sediment has been utilized as control

sediment over the previous 15 years with acceptable control results. The animals were fed ~1 mL of a prepared invertebrate food daily. Feeding volumes were adjusted during testing to maintain acceptable dissolved oxygen levels in the overlying water. The number of live and dead animals in each test chamber were enumerated at test termination (day 10) by sieving the sediment through a No. 35 (500- μ m) and/or No. 40 (425- μ m) sieve. Animals were considered dead if they did not respond to a gentle physical stimulus. The criterion for test acceptability was mean survival in the controls of $\geq 70\%$. Ash free dry weights were conducted by placing animals into an ashed and pre-tared weigh boat and drying at 60-90 °C for 24 hours. Weigh boats were placed into a dessicator to cool and then reweighed. Weigh boats were then placed into a muffle furnace at approximately 550 °C for 2.5 hours. Weigh boats were allowed to cool in a dessicator and then reweighed.

2.3.2 10-Day Bioaccumulation

The test procedures utilized in the performance of the 10-day midge bioaccumulation test were based upon those general procedures described above. Each control and site sample was replicated four times using 11.3-L aquaria with base dimensions of 15.8 by 30.5 cm. These base dimensions yielded a surface area of 482 cm². Approximately 300 1-3 day post hatch *C. riparius* larvae were added to each replicate. This rate, 1.6 cm² per organism, is similar to that suggested by OECD Guideline 218 (3). The overlying water was renewed using the same automated renewal system discussed above. One to two centimeters of control or site sample sediment was added to each aquarium the day prior to the addition of test organisms. Replicates one and two were initiated on June 20 and replicates three and four were initiated on June 21, 2003. Live animals in each test chamber were removed at test termination (day 10) by sieving the sediment through a No. 35 (500- μ m) or No. 40 (425- μ m) sieve. Once larvae were collected they were placed into labeled polyethylene bottles and placed in a cooler with dry ice. Upon completion of the animal collection the samples were stored in a freezer until being shipped to EMAX laboratories for analysis.

2.4 Environmental Monitoring

The monitoring routine for the environmental conditions during testing is summarized in Table 2. The test chambers were maintained in a temperature-controlled water bath adjusted to maintain a sediment temperature of $20 \pm 1^\circ\text{C}$ under a 16 hour light:8 hour dark photoperiod. Temperature and dissolved oxygen in all replicates were measured daily. Conductivity, total ammonia, pH, alkalinity, and hardness were measured on day zero and ten. Water bath and environmental chamber temperatures were monitored continuously using an electronic data logging system. Overlying water temperature and DO were measured using a WTW OXi 330 dissolved oxygen meter. A Denver Instruments pH meter was used to measure pH. Light intensity was measured using a Li-Cor Model LI-189 light meter equipped with a photometric sensor. Conductivity was measured with an Orion model 140 salinity/conductivity meter. Total ammonia, hardness, and alkalinity were conducted using a colorimetric method by HACH

Company, Loveland, Colorado.

2.5 Statistical Analyses

Statistical significance for animal survival was determined by hypothesis testing. ABC Laboratories utilized a specially written SAS program to calculate statistically significant differences from controls at the $P = 0.05$ level (4). Analyses of each endpoint between samples was evaluated by first analyzing the data for normality and homogeneity of variances with Shapiro-Wilk's Test and either Bartlett's, Hartley's, or Levene's Test, respectively, before comparison of means. If the data were normally distributed and the variances were homogeneous, then analysis of variances (ANOVA) was utilized along with Dunnett's or Fisher's procedure for comparing the means. Survival data were analyzed using Fisher's Exact test and growth data were analyzed with Dunnett's. If the assumptions of normality or homogeneity of variance were not met, transformations of the survival data were employed to allow the use of parametric procedures. If transformations (e.g., arc sine-square root transformation) of the data still did not meet assumptions of normality and homogeneity, then a non-parametric test was used to analyze these data.

3.0 RESULTS AND DISCUSSION

3.1 Survival

Survival percentages for all replicate test chambers are presented in Table 3. Survival ranged from 4 percent in sample RW1001 to 46 percent in sample RW1011. Survival in the ABC Control and reference site was 82 and 33 percent respectively. All site samples including the reference site were significantly reduced for survival as compared to the ABC Control. Site samples RW1001 and RW1005 were significantly reduced as compared to the reference site. The control met the test acceptability criterion for survival. Survival data are located in Appendix B.

3.2 Growth

Ash free dry weight measurements of midge for all replicate chambers are presented in Table 4. Ash free dry weight ranged from 0.0002 grams in sample RW1002 to 0.0006 grams in sample RW1007, RW1009, and RW1011. Ash free dry weight in the ABC Control and the reference site was 0.0003 and 0.0010 grams respectively. There was no significant reduction in ash free dry weight as compared to control for any of the site samples. Site samples RW1001, RW1002, RW1004, RW1005, RW1006, RW1007, and RW1008 were significantly reduced for ash free dry weight as compared to the reference site. The ABC control was significantly reduced as compared to the reference site.

3.3 Bioaccumulation

The organisms removed from these replicates were utilized solely for generation of tissue for chemical analysis at EMAX Laboratories. The number of organisms removed was estimated for analytical use only.

3.4 Environmental Monitoring Results

The continuously recorded water bath temperatures ranged from 19.2 to 20.7°C with a mean temperature of 19.9°C during the 7-day exposure. Water bath temperature ranged from 19.9 to 20.5°C as recorded daily with a mercury thermometer. Overlying water temperatures were maintained between 19.2 and 20.7°C as recorded daily in each sample. Dissolved oxygen (DO) in the overlying water ranged from 4.8 to 9.8 mg/L during the test. Water quality ranges can be found in Table 5. All water quality parameters were within acceptable limits for maintenance of healthy *Chironomus riparius* populations.

4.0 Conclusions

All site samples including the reference site were significantly reduced for survival as compared to the ABC Control. Site samples RW1001 and RW1005 were significantly reduced as compared to the reference site. There was no significant reduction in ash free dry weight as compared to the control for any of the site samples. Site samples RW1001, RW1002, RW1004, RW1005, RW1006, RW1007, and RW1008 were significantly reduced for ash free dry weight as compared to the reference site. The ABC control was significantly reduced as compared to the reference site.

Poor survival rates in the site samples including the reference site may be attributed to the composition of the samples. Typically, midges do not thrive in rocky/gravel areas low in organic content. All samples received contained primarily gravel as the substrate. The replicates that had higher survival rates may have had a certain amount of additional organic material in the form of leaves, grass, or roots.

5.0 REFERENCES

1. American Society for Testing and Materials (ASTM). 1995. Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates (ASTM Method E 1706 - 95b).
2. U.S. EPA. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Fresh water Invertebrates (EPA-600/R-99/064).
3. OECD 2002. Guidelines For The Testing of Chemicals, Sediment-Water Chironomid Toxicity Test Using Spiked Sediment. OECD Guideline 218 December 2002
4. The SAS System for Windows, Release 6.10. Copyright 1989-1996 by SAS Institute Inc., Cary, North Carolina, 27512-8000 USA.

Table 1. Sample Receipt and Identification

Sample Name	Sample ID	Date Received
HR-78Q-SW/SD01-SD-RW1001-REG	RW1001	June 18, 2003
SAR-78-SW/SD10-SD-RW1002-REG	RW1002	June 18, 2003
SAR-85-SW/SD05-SD-RW1004-REG	RW1004	June 18, 2003
SAR-85-SW/SD08-SD-RW1005-REG	RW1005	June 11, 2003
SAR-77-SW/SD25-SD-RW1006-REG	RW1006	June 19, 2003
SAR-85-SW/SD02-SD-RW1007-REG	RW1007	June 18, 2003
SAR-77-SW/SD23-SD-RW1008-REG	RW1008	June 18, 2003
HR-85Q-SW/SD02-SD-RW1009-REG	RW1009	June 18, 2003
HR-80Q-SW/SD03-SD-RW1010-REG	RW1010	June 19, 2003
HR-80Q-SW/SD06-SD-RW1011-REG	RW1011	June 19, 2003
REFST-SD-RW1012-REG	RW1012ref	June 19, 2003

Table 2. Routine Environmental Conditions and Frequency of Measurement

Environmental Condition	Frequency of Measurement	Measurement Location
Temperature	Continuously	Water Bath
Overlying Water Temperature	Daily	One Replicate of each Control & Site Samples
Dissolved Oxygen	Daily	All Control & Site Samples
Overlying Water pH	Day 0 &10	Composite Samples
Conductivity	Day 0 &10	Composite Samples
Total Ammonia	Day 10	Composite Samples
Alkalinity	Day 0 &10	Composite Samples
Hardness	Day 0 &10	Composite Samples

Table 3. Replicate Percent Survival

Sample ID	Percent survival								
	Replicate								Treatment Mean ^a
	1	2	3	4	5	6	7	8	
ABC (1-8)	70	100	80	60	80	70	90	80	82
ABC (9-16)	80	60	70	80	100	90	100	100	
RW1001	0	10	0	0	10	0	10	0	4 ^b
RW1002	0	10	10	0	20	30	10	60	18
RW1004	20	10	10	0	30	30	0	20	15
RW1005	0	0	20	0	10	10	30	10	10 ^b
RW1006	40	30	20	0	30	10	40	20	24
RW1007	10	30	70	20	10	10	10	0	20
RW1008	30	20	20	20	10	10	20	40	21
RW1009	20	10	10	20	40	40	10	10	20
RW1010	0	10	0	20	20	40	40	0	16
RW1011	60	30	60	70	40	30	40	40	46
RW1012ref	60	20	30	20	80	10	20	20	33

^a All samples with significant difference as compared to the ABC Control.

^b Significantly reduced as compared to the reference site RW1012ref.

Table 4. Replicate Ash Free Dry Weight

Sample ID	Replicate Ash Free Dry Weight (grams)								
	Replicate								Treatment Mean per Organism
	1	2	3	4	5	6	7	8	
ABC (1-8)	0.0032	0.0026	0.0027	0.0019	0.0026	0.0028	0.0043	0.0037	0.0003 ^a
ABC (9-16)	0.0031	0.0018	0.0032	0.0019	0.0025	0.0020	0.0036	0.0027	
RW1001	NA	0.0004	NA	NA	0.0004	NA	0.0003	NA	0.0004 ^a
RW1002	NA	0.0002	0.0001	NA	0.0002	0.0007	0.0003	0.0020	0.0003 ^a
RW1004	0.0004	0.0003	0.0003	NA	0.0010	0.0013	NA	0.0011	0.0004 ^a
RW1005	NA	NA	0.0007	NA	0.0002	0.0005	0.0009	0.0003	0.0003 ^a
RW1006	0.0016	0.0008	0.0009	NA	0.0007	0.0006	0.0018	0.0006	0.0004 ^a
RW1007	0.0005	0.0010	0.0058	0.0008	0.0002	0.0014	0.0004	NA	0.0006 ^a
RW1008	0.0013	0.0015	0.0006	0.0007	0.0004	0.0009	0.0010	0.0018	0.0005 ^a
RW1009	0.0010	0.0005	0.0007	0.0014	0.0031	0.0017	0.0005	0.0005	0.0006
RW1010	NA	0.0006	NA	0.0007	0.0010	0.0020	0.0027	NA	0.0005
RW1011	0.0039	0.0023	0.0033	0.0028	0.0024	0.0021	0.0034	0.0020	0.0006
RW1012ref	0.0047	0.0009	0.0028	0.0033	0.0072	0.0009	0.0028	0.0025	0.0010

NA = Not Applicable, 100% mortality in this replicate

^a Significantly reduced as compared to the RW1012ref reference site.

Table 5. Overlying Water Quality Ranges

Overlying Water Quality Ranges		
Sample ID	Temperature (°C)	Dissolved Oxygen (mg/L)
ABC (1-8)	19.3 – 20.7	5.0 – 9.1
ABC (9-16)		
RW1001	19.4 – 20.6	5.5 – 9.7
RW1002	19.4 – 20.6	5.5 – 9.6
RW1004	19.4 – 20.5	6.3 – 9.8
RW1005	19.2 – 20.4	5.1 – 9.7
RW1006	19.4 – 20.4	4.8 – 9.8
RW1007	19.5 – 20.4	5.7 – 9.8
RW1008	19.4 – 20.5	5.6 – 9.5
RW1009	19.4 – 20.4	5.8 – 9.6
RW1010	19.4 – 20.4	6.0 – 9.6
RW1011	19.3 – 20.3	5.5 – 9.4
RW1012ref	19.4 – 20.4	5.5 – 9.5

Appendix A

Chain-of-Custody Documentation



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-061703-ABC

Page 1 of 2

Project Number: 800486

Samples Shipment Date: 17 JUN 2003

Bill To: Duane Nielsen

Project Name: Fort McClellan

Lab Destination: ABC Laboratories

312 Directors Drive

Knoxville

TN 37923

Sample Coordinator: ~~Oliver Allen~~ *Kathy Hays*

Lab Contact: Mickey Kernodle

Report To: Duane Nielsen

Turnaround Time: *Normal*

Project Contact: Tim Roth

312 Directors Drive

Knoxville

TN 37923

Carrier/Waybill No.: UPS/

Special Instructions: None	
Possible Hazard Identification: Radiological <input type="checkbox"/>	
Non-hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
Sample Disposal: Archive (mos.)	
Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/>	
1. Relinquished By (Signature/Affiliation) <i>Kathy Hays SHAW E&I</i>	Date: <i>6/17/03</i> Time: <i>1900</i>
1. Received By (Signature/Affiliation) <i>Mickey Kernodle</i>	Date: <i>June 19, 03</i> Time: <i>11:00 AM</i>
2. Relinquished By (Signature/Affiliation)	Date: Time:
2. Received By (Signature/Affiliation)	Date: Time:
3. Relinquished By (Signature/Affiliation)	Date: Time:
3. Received By (Signature/Affiliation)	Date: Time:
Comments: None	

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File	CID	Condition On Receipt
RW1001	HR-78Q-SW/SD01-SD-RW1001-REG	11 JUN 2003	14:50	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N		
RW1002	SAR-78-SW/SD10-SD-RW1002-REG	11 JUN 2003	13:30	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N		
RW1004	SAR-85-SW/SD05-SD-RW1004-REG	09 JUN 2003	13:30	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N		
RW1005	SAR-85-SW/SD08-SD-RW1005-REG	09 JUN 2003	15:00	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N		
RW1007	SAR-85-SW/SD02-SD-RW1007-REG	09 JUN 2003	10:00	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N		



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-061703-ABC

Page 2 of 2

Sample No	Sample Name	Sample Date	Sample Time	Container	Preservative	Requested Testing Program	File	CID	Condition On Receipt
RW1009	HR-85Q-SW/SD02-SD-RW1009-REG	09 JUN 2003	12:30	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N	

ENVIRONMENTAL SAMPLES--CHEMISTRY ON RECEIPT

Sponsor: EMAX/SHAW Study No.: 48235
 Sample Type: Effluent Sediment Soil Other: _____

Data By: TKR Date: June 18 03

Sample ID	Temp. °C	D.O. mg/L	pH	Cond. µS/cm	Salinity ‰	Hard ^a mg/L	Alk ^a mg/L	NH ₃ ^b mg/L	Cl ₂ ^b mg/L
RW1001	5.4		5.56						
RW1002	3.0		5.63						
RW1004	5.0		5.08						
RW1005	3.5		5.62						
RW1006									
RW1007	2.6		5.45						
RW1008	3.0		5.10						
RW1009	3.8		5.39						
Device ID's	MT-11		PH-C						① R TKR Jun 18/03

^a colorimetric titration procedure adapted from APHA standard methods (mg/L as CaCO₃)

^b colorimetric method by HACH Co. for total ammonia and total chlorine



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-061803-ABC

Page 1 of 1

Project Number: 800486

Samples Shipment Date: 18 JUN 2003

Bill To: Duane Nielsen

Project Name: Fort McClellan

Lab Destination: ABC Laboratories

312 Directors Drive

Knoxville

TN 37923

Sample Coordinator: ~~Oliver Allen~~ *Keith Hogue*

Lab Contact: Mickey Kernodle

Report To: Duane Nielsen

Turnaround Time: *Normal*

Project Contact: Tim Roth

312 Directors Drive

Knoxville

TN 37923

Carrier/Waybill No.: UPS/

Special Instructions: None	
Possible Hazard Identification: Radiological <input type="checkbox"/>	
Non-hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
Sample Disposal: Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/> Archive (mos.)	
1. Relinquished By (Signature/Affiliation) <i>Keith Hogue</i> <i>SHW E E I</i>	Date: <i>6/18/03</i> Time: <i>1400</i>
2. Relinquished By (Signature/Affiliation)	Date: Time:
3. Relinquished By (Signature/Affiliation)	Date: Time:
1. Received By (Signature/Affiliation) <i>Mickey Kernodle</i>	Date: <i>JUN 19, 03</i> Time: <i>10:45</i>
2. Received By (Signature/Affiliation)	Date: Time:
3. Received By (Signature/Affiliation)	Date: Time:
Comments: None	

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW1006	SAR-77-SW/SD25-SD-RW1006-REG	12 JUN 2003	08:15	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N	
RW1010	HR-80Q-SW/SD03-SD-RW1010-REG	12 JUN 2003	11:00	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N	
RW1011	HR-80Q-SW/SD06-SD-RW1011-REG	12 JUN 2003	12:15	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N	
RW1012	REFST-SD-RW1012-REG	11 JUN 2003	14:50	1 GAL P.Bucket	3	None except cool to 4 C	Chironomus Riparius Survival & Growth Test - EPA 100.2	N	

ENVIRONMENTAL SAMPLES--CHEMISTRY ON RECEIPT

Sponsor: EMAX/SHAW Study No.: 48235
 Sample Type: Effluent Sediment Soil Other: _____

Data By: RM Date: June 19, 03

Sample ID	Temp. °C	D.O. mg/L	pH	Cond. µS/cm	Salinity ‰	Hard ^a mg/L	Alk ^a mg/L	NH ₃ ^b mg/L	Cl ₂ ^b mg/L
RW1012	3.5		6.05						
RW1011	2.0		5.66						
RW1006	2.0		4.98						
RW1010	3.6		5.37						
Device ID's	MT-11		PH6						

① R. MK June 19, 03

^a colorimetric titration procedure adapted from APHA standard methods (mg/L as CaCO₃)
^b colorimetric method by HACH Co. for total ammonia and total chlorine

ATTACHMENT 4

**PHYSICAL CHARACTERIZATION/WATER QUALITY
FIELD DATA SHEETS**

SAR 75 50 02

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <u>Cane Creek</u>	LOCATION <u>Ft. McClellan (FTMC)</u>	
STATION # <u>SAR 85</u> RIVERMILE _____	STREAM CLASS _____	
LAT _____ LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <u>EPA</u>	
INVESTIGATORS <u>R.S. Prann, M. Murray, L. Yates</u>		
FORM COMPLETED BY <u>M. Murray</u>	DATE <u>6/9/02</u> TIME <u>0945</u> AM PM	REASON FOR SURVEY <u>BERA Sampling</u>

WEATHER CONDITIONS <u>Clear</u> <u>80°F</u> <u>light wind</u>	Now	Past 24 hours	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	<input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input checked="" type="checkbox"/> %cloud cover clear/sunny	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> %	Air Temperature <u>80</u> °F Other _____

SITE LOCATION/MAP <u>See Plan</u> <u>Figure 9-4</u>	Draw a map of the site and indicate the areas sampled (or attach a photograph) <u>See BERA Work Plan</u> <u>Figure 9-4 -</u> <u>Site photos</u>
---	--

STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater
	Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Catchment Area _____ km ²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

SAR 85 5002

WATERSHED FEATURES	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <i>Former Army Base</i> <input type="checkbox"/> Residential	Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input checked="" type="checkbox"/> Obvious sources
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <i>oak/pine - some alder</i>	
INSTREAM FEATURES	Estimated Reach Length <i>60</i> m Estimated Stream Width <i>2</i> m Sampling Reach Area <i>—</i> m ² Area in km ² (m ² x1000) <i>—</i> km ² Estimated Stream Depth <i>0.2</i> m Surface Velocity <i>0.25</i> m/sec (at thalweg)	Canopy Cover <input checked="" type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark <i>1.0</i> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <i>15</i> % <input type="checkbox"/> Run <i>75</i> % <input type="checkbox"/> Pool <i>5</i> % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
LARGE WOODY DEBRIS	LWD <i>0</i> m ² Density of LWD <i>0</i> m ² /km ² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present <i>as appears to be algae but not firmly attached golden brown in color</i> Portion of the reach with aquatic vegetation <i>90</i> %	
WATER QUALITY	Temperature <i>19.6</i> °C Specific Conductance <i>0.02</i> mS/cm Dissolved Oxygen <i>9.02</i> mg/L pH <i>5.75</i> Turbidity <i>—</i> WQ Instrument Used <i>Hanna U10</i>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		<i>20</i>	Detritus	sticks, wood, coarse plant materials (CPOM)	<i>27.025</i> <i>25</i>
Boulder	> 256 mm (10")	<i>20</i>			
Cobble	64-256 mm (2.5"-10")	<i>40</i>	Muck-Mud	black, very fine organic (FPOM)	<i>0</i>
Gravel	2-64 mm (0.1"-2.5")	<i>15</i>			
Sand	0.06-2mm (gritty)	<i>5</i>	Marl	grey, shell fragments	<i>0</i>
Silt	0.004-0.06 mm	<i>0</i>			
Clay	< 0.004 mm (slick)	<i>0</i>			

SAR 75 SD 02

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>Cane Creek</i>	LOCATION <i>ETMC</i>
STATION # _____ RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>R.S. Priddy, M. Murray, L. Yates</i>	
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/9/05</i> TIME <i>0945</i> AM PM REASON FOR SURVEY <i>DERA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	10 9 8 7 6 5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	10 9 8 7 6 5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	10 9 8 7 6 5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	10 9 8 7 6 5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	10 9 8 7 6 5 4 3 2 1 0

SAR 85 P10 02

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE __ (LB)	Left Bank 10 9	8 7 6	5 4 3 2 1 0	
SCORE __ (RB)	Right Bank 10 9	8 7 6	5 4 3 2 1 0	
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE __ (LB)	Left Bank 10 9	8 7 6	5 4 3 2 1 0	
SCORE __ (RB)	Right Bank 10 9	8 7 6	5 4 3 2 1 0	
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE __ (LB)	Left Bank 10 9	8 7 6	5 4 3 2 1 0	
SCORE __ (RB)	Right Bank 10 9	8 7 6	5 4 3 2 1 0	

Parameters to be evaluated broader than sampling reach

Total Score _____

SAR 75 SID 02

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <u>Cane Creek</u>	LOCATION <u>FTMC</u>
STATION # <u>SAR 75</u> RIVERMILE <u>5202</u>	STREAM CLASS <u>—</u>
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <u>EPA</u>
INVESTIGATORS <u>R. S. Primm, M. Murray, C. Yate</u>	LOT NUMBER _____
FORM COMPLETED BY <u>M. Murray</u>	DATE <u>6/8/03</u> TIME <u>09:45</u> AM PM
	REASON FOR SURVEY <u>BERA sampling</u>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <u>40</u> % <input type="checkbox"/> Snags <u>0</u> % <input type="checkbox"/> Vegetated Banks <u>100</u> % <input type="checkbox"/> Sand <u>5</u> % <input type="checkbox"/> Submerged Macrophytes <u>0</u> % <input type="checkbox"/> Other (<u> </u>) _____ %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other <u>Be. S. rock / boulder 40%</u> How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input checked="" type="checkbox"/> Cobble <u>2</u> <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other (_____) _____
GENERAL COMMENTS	<u>1 kicknet in riffle - 1 in run - combined</u> <u>1 CPOM separate sample</u>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0 1 2 3 4	Slimes	0 1 2 3 4
Filamentous Algae	0 1 2 3 4	Macroinvertebrates	0 1 2 3 4
Macrophytes	0 1 2 3 4	Fish	0 1 2 3 4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0 1 2 3 4	Anisoptera	0 1 2 3 4	Chironomidae	0 1 2 3 4
Hydrozoa	0 1 2 3 4	Zygoptera	0 1 2 3 4	Ephemeroptera	0 1 2 3 4
Platyhelminthes	0 1 2 3 4	Hemiptera	0 1 2 3 4	Trichoptera	0 1 2 3 4
Turbellaria	0 1 2 3 4	Coleoptera	0 1 2 3 4	Other	0 1 2 3 4
Hirudinea	0 1 2 3 4	Lepidoptera	0 1 2 3 4	see results of lab taxonomy	
Oligochaeta	0 1 2 3 4	Sialidae	0 1 2 3 4		
Isopoda	0 1 2 3 4	Corydalidae	0 1 2 3 4		
Amphipoda	0 1 2 3 4	Tipulidae	0 1 2 3 4		
Decapoda	0 1 2 3 4	Empididae	0 1 2 3 4		
Gastropoda	0 1 2 3 4	Simuliidae	0 1 2 3 4		
Bivalvia	0 1 2 3 4	Tabinidae	0 1 2 3 4		
		Culcidae	0 1 2 3 4		

SAR 85 SD 08

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <i>Cane Creek</i>	LOCATION <i>FT MC</i>	
STATION # <i>SAR 85</i> RIVERMILE _____	STREAM CLASS _____	
LAT <i>37 08</i> LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <i>EPA</i>	
INVESTIGATORS <i>RS Prann, M. Murray, C. Yates</i>		
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/9/07</i> TIME <i>7:50</i> AM <input checked="" type="checkbox"/> PM	REASON FOR SURVEY <i>BERA Sampling</i>

WEATHER CONDITIONS	Now <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input checked="" type="checkbox"/> %cloud cover <input checked="" type="checkbox"/> clear/sunny	Past 24 hours <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % <input checked="" type="checkbox"/>	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Air Temperature <i>85°F</i> Other _____
	SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph) <p style="text-align: center;"><i>See Figure 9-4 Bera plan - site photos</i></p>		
STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater Catchment Area _____ km ²	

3AR 85 1008
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
 (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <u>fermy ranges</u> <input type="checkbox"/> Residential	Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input checked="" type="checkbox"/> Obvious sources
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Alder</u>	
INSTREAM FEATURES	Estimated Reach Length <u>50</u> m Estimated Stream Width <u>2</u> m Sampling Reach Area <u>✓</u> m ² Area in km ² (m ² x1000) <u>-</u> km ² Estimated Stream Depth <u>0.2</u> m Surface Velocity <u>0.4</u> m/sec (at thalweg)	Canopy Cover <input checked="" type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark <u>1.0</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <u>75</u> % <input type="checkbox"/> Run <u>25</u> % <input type="checkbox"/> Pool <u>0</u> % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
LARGE WOODY DEBRIS	LWD <u>0</u> m ² Density of LWD <u>0</u> m ² /km ² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present <u>appears to be algae with reddish brown fluc.</u> Portion of the reach with aquatic vegetation <u>90</u> %	
WATER QUALITY	Temperature <u>23.5</u> °C Specific Conductance <u>0.022</u> mS/cm Dissolved Oxygen <u>8.39</u> mg/L pH <u>6.73</u> Turbidity <u>-</u> WQ Instrument Used <u>Hanna V10</u>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	<u>25</u>
Boulder	> 256 mm (10")	<u>30</u>			
Cobble	64-256 mm (2.5"-10")	<u>40</u>	Muck-Mud	black, very fine organic (FPOM)	<u>0</u>
Gravel	2-64 mm (0.1"-2.5")	<u>20</u>			
Sand	0.06-2mm (gritty)	<u>10</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>0</u>			
Clay	< 0.004 mm (slick)	<u>0</u>			

SAR 85 5008

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>Cano Creek</i>	LOCATION <i>FTMC</i>
STATION # <i>SAR 85</i> RIVERMILE _____	STREAM CLASS _____
LAT <i>3509</i> LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>R.S. Priddy, M. Murray, L. Yates</i>	
FORM COMPLETED BY <i>M. Murray</i>	DATE TIME <i>6/9/83</i> <i>1450</i> AM (PM) REASON FOR SURVEY <i>BERA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	70	40	20	10
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	70	40	20	10
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	70	40	20	10
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	70	40	20	10
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	70	40	20	10

S.A.R. 85 5008

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream.	Moderately stable; infrequent; small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
9. Vegetative Protection (score each bank) More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
SCORE (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0

Parameters to be evaluated broader than sampling reach

Total Score _____

SAR 85 5008

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <i>Cane Creek</i>	LOCATION <i>FTMC</i>
STATION # <i>SAR 85</i> RIVERMILE _____	STREAM CLASS _____
LAT <i>5008</i> LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>R S Praun, M. Murray, L. Yaffee</i>	PLOT NUMBER _____
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/2/03</i> TIME <i>1:50</i> AM (PM) <input checked="" type="radio"/>
	REASON FOR SURVEY <i>BERA Sampling</i>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <i>40</i> % <input type="checkbox"/> Snags <i>0</i> % <input type="checkbox"/> Vegetated Banks <i>100</i> % <input type="checkbox"/> Sand <i>75</i> % <i>(less than 5%)</i> <input type="checkbox"/> Submerged Macrophytes _____ % <input type="checkbox"/> Other () _____ %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble <i>2</i> <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other () _____
GENERAL COMMENTS	<i>1 riffle, 1 run sample taken and composited 1 CPOM sample collected separately.</i>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0 1 2 3 <i>4</i>	Slimes	<i>0</i> 1 2 3 4
Filamentous Algae	<i>0</i> 1 2 3 4	Macroinvertebrates	0 <i>1</i> 2 3 4
Macrophytes	<i>0</i> 1 2 3 4	Fish	<i>0</i> 1 2 3 4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0 1 2 3 4	Anisoptera	0 1 2 3 4	Chironomidae	0 1 2 3 4
Hydrozoa	0 1 2 3 4	Zygoptera	0 1 2 3 4	Ephemeroptera	0 1 2 3 4
Platyhelminthes	0 1 2 3 4	Hemiptera	0 1 2 3 4	Trichoptera	0 1 2 3 4
Turbellaria	0 1 2 3 4	Coleoptera	0 1 2 3 4	Other	0 1 2 3 4
Hirudinea	0 1 2 3 4	Lepidoptera	0 1 2 3 4	<i>see results of lab taxonomy</i>	
Oligochaeta	0 1 2 3 4	Sialidae	0 1 2 3 4		
Isopoda	0 1 2 3 4	Corydalidae	0 1 2 3 4		
Amphipoda	0 1 2 3 4	Tipulidae	0 1 2 3 4		
Decapoda	0 1 2 3 4	Empididae	0 1 2 3 4		
Gastropoda	0 1 2 3 4	Simuliidae	0 1 2 3 4		
Bivalvia	0 1 2 3 4	Tabinidae	0 1 2 3 4		
		Culcidae	0 1 2 3 4		

SAR 85 SD 05

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

SAR 85 SD 075 (FRONT)

STREAM NAME <i>Cane Creek</i>	LOCATION <i>PTMC</i>
STATION # <i>SD 05</i> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>R.S. Prawn, M. Murray, L. Yates</i>	
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/9/03</i> TIME <i>1340</i> AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>
	REASON FOR SURVEY <i>BERA Sampling</i>

WEATHER CONDITIONS	Now	Past 24 hours	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	<input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input checked="" type="checkbox"/> %cloud cover clear/sunny	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> %	Air Temperature <i>85°F</i> Other _____

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) <p style="text-align: center;"><i>See Fig 9-4 BERA Plan - site photos</i></p>
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STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater
	Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Catchment Area _____ km ²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

SAR 85 SD 075 (BACK) mm 6/9/03

WATERSHED FEATURES	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <i>old firing ranges</i> <input type="checkbox"/> Residential	Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input checked="" type="checkbox"/> Obvious sources
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Alder</u>	
INSTREAM FEATURES	Estimated Reach Length <u>50</u> m Estimated Stream Width <u>3</u> m Sampling Reach Area <u>-</u> m ² Area in km ² (m ² x1000) <u>-</u> km ² Estimated Stream Depth <u>0.2</u> m Surface Velocity <u>0.4</u> m/sec (at thalweg)	Canopy Cover <input type="checkbox"/> Partly open <input checked="" type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark <u>1.0</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <u>10</u> % <input type="checkbox"/> Run <u>90</u> % <input type="checkbox"/> Pool <u>0</u> % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
LARGE WOODY DEBRIS	LWD <u>0</u> m ² Density of LWD <u>0</u> m ² /km ² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present <u>appear to be algae with blue/golden brown color</u> Portion of the reach with aquatic vegetation <u>90</u> %	
WATER QUALITY	Temperature <u>22.0</u> °C Specific Conductance <u>0.019</u> uS/cm Dissolved Oxygen <u>8.62</u> mg/L pH <u>6.69</u> Turbidity <u>-</u> WQ Instrument Used <u>Hanna U10</u>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	< 5
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	0			
Clay	< 0.004 mm (slick)	0			

SAR 85 SD 0X / ~~606 8005~~
 4/19/03

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>Cane Creek</i>	LOCATION <i>FTMC</i>
STATION # <i>SAR 85 SD 0X</i> RIVERMILE _____	STREAM CLASS _____
LAT <i>35 03</i> LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>RS Prann, M. Murray, C. Yates</i>	
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/19/03</i> TIME <i>1345</i> AM <input checked="" type="radio"/> PM <input type="radio"/>
	REASON FOR SURVEY <i>BERA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	6	3	1	0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	4	3	2	1
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	4	3	2	1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	4	3	2	1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	4	3	2	1

SAR 85 SD 085
 Date 6/9/03

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE ___ (LB)	Left Bank 10	Right Bank 10		
SCORE ___ (RB)	Left Bank 10	Right Bank 10		
9. Vegetative Protection (score each bank) More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE ___ (LB)	Left Bank 10	Right Bank 10		
SCORE ___ (RB)	Left Bank 10	Right Bank 10		
10. Riparian Vegetative Zone Width (score each bank riparian zone) Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
SCORE ___ (LB)	Left Bank 10	Right Bank 10		
SCORE ___ (RB)	Left Bank 10	Right Bank 10		

Parameters to be evaluated broader than sampling reach

Total Score _____

SAR 8550 075 - ~~Historic 5005~~
 Mar 6/9/03

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <i>Cano Creek</i>	LOCATION <i>FTMC</i>
STATION # <i>SA 8550 075</i> RIVER MILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>R.S. Prann, M. Murray, L. Yato</i>	LOT NUMBER _____
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>8/9/03</i> TIME <i>7:40</i> AM <input checked="" type="checkbox"/> PM
	REASON FOR SURVEY <i>BERA sampling</i>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <i>40%</i> <input type="checkbox"/> Snags <i>25%</i> <input type="checkbox"/> Vegetated Banks <i>95%</i> <input type="checkbox"/> Sand <i>5%</i> <input type="checkbox"/> Submerged Macrophytes <i>0%</i> <input type="checkbox"/> Other () _____%
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <i>1 riffle, 1 run, 1 CPOM</i> <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input checked="" type="checkbox"/> Other () _____
GENERAL COMMENTS	<i>Little CPOM noted riffle and run samples combined, CPOM separate sample.</i>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0	1	2	<input checked="" type="radio"/> 3	4	Slimes	<input checked="" type="radio"/> 1	2	3	4	
Filamentous Algae	<input checked="" type="radio"/> 0	1	2	3	4	Macroinvertebrates	0	<input checked="" type="radio"/> 1	2	3	4
Macrophytes	<input checked="" type="radio"/> 0	1	2	3	4	Fish	<input checked="" type="radio"/> 0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4	<i>see results of lab taxonomy</i>					
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

SAR 78 SD 10

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <i>Cane Creek</i>	LOCATION <i>FTMC</i>	
STATION # <i>SD 10</i> RIVERMILE _____	STREAM CLASS _____	
LAT _____ LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <i>EPA</i>	
INVESTIGATORS <i>RS Praun M Murray Gates</i>		
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/11/03</i> TIME <i>1330</i> AM <input checked="" type="radio"/> PM	REASON FOR SURVEY <i>BERA Sampling</i>

WEATHER CONDITIONS	Now	Past 24 hours	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	<input type="checkbox"/> storm (heavy rain) <input checked="" type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover _____ <input type="checkbox"/> clear/sunny	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % _____ <input checked="" type="checkbox"/>	Air Temperature <i>88°F</i> Other _____

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) <p style="text-align: center;"><i>See BERA Figure 9-4 - site photos</i></p>
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STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater
	Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Catchment Area _____ km ²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

SAR 78 SD 10 (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input type="checkbox"/> Residential <input checked="" type="checkbox"/> Other <i>old firing ranges</i>	Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input checked="" type="checkbox"/> Obvious sources
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Alder</u>	
INSTREAM FEATURES	Estimated Reach Length <u>20</u> m Estimated Stream Width <u>2.5</u> m Sampling Reach Area <u> </u> m ² Area in km ² (m ² x1000) <u> </u> km ² Estimated Stream Depth <u>0.2</u> m Surface Velocity <u>0.25</u> m/sec (at thalweg)	Canopy Cover <input checked="" type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark <u>1</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <u>25</u> % <input type="checkbox"/> Run <u>75</u> % <input type="checkbox"/> Pool <u> </u> % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
LARGE WOODY DEBRIS	LWD <u>0</u> m ² Density of LWD <u>0</u> m ² /km ² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present <u> </u> Portion of the reach with aquatic vegetation <u>70</u> %	
WATER QUALITY	Temperature <u>24.1</u> °C Specific Conductance <u>0.018</u> mS/cm Dissolved Oxygen <u>8.33</u> mg/L pH <u>6.66</u> Turbidity <u> </u> WQ Instrument Used <u>Horiba U10</u>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other <u> </u> Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other <u> </u> Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other <u> </u>
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other <u> </u> Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other <u> </u> Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <u>Some orange on underside</u>	

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	0
Boulder	> 256 mm (10")	205	Muck-Mud	black, very fine organic (FPOM)	0
Cobble	64-256 mm (2.5"-10")	46			
Gravel	2-64 mm (0.1"-2.5")	30	Marl	grey, shell fragments	0
Sand	0.06-2mm (gritty)	5			
Silt	0.004-0.06 mm	0			
Clay	< 0.004 mm (slick)	0			

SAR 7895010
 mm 4/1/03

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>Cane Creek</i>	LOCATION <i>FTMC</i>	
STATION # <i>SD10</i> RIVERMILE _____	STREAM CLASS _____	
LAT _____ LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <i>EPA</i>	
INVESTIGATORS <i>R.S. Prange M. Murray L. Yates</i>		
FORM COMPLETED BY _____	DATE <i>6/11/03</i> TIME <i>1330</i> AM <input checked="" type="checkbox"/>	REASON FOR SURVEY <i>BERA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE				
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE				
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE				
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE				
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE				

SAR 78th SD 10

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE __ (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE __ (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
9. Vegetative Protection (score each bank) More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE __ (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE __ (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
SCORE __ (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE __ (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0

Parameters to be evaluated broader than sampling reach

Total Score _____

SAR 78 SD 10

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <u>CANE CREEK</u>	LOCATION <u>PTMC</u>
STATION # <u>SD10</u> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <u>EPA</u>
INVESTIGATORS <u>R.S. Prann, L. Vata, M. Murray</u>	LOT NUMBER _____
FORM COMPLETED BY <u>M. Murray</u>	DATE <u>6/10/03</u> TIME <u>11:30</u> AM PM
	REASON FOR SURVEY <u>BERA Sampling</u>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <u>40</u> % <input type="checkbox"/> Snags <u>0</u> % <input type="checkbox"/> Vegetated Banks <u>80</u> % <input type="checkbox"/> Sand <u>5</u> % <input type="checkbox"/> Submerged Macrophytes <u>0</u> % <input type="checkbox"/> Other (_____) _____ %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other (<u>Truffle + IRON</u>) _____
GENERAL COMMENTS	<u>Truffle and Iron samples composited. separate POM sample collected</u>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4	<i>see results of lab taxonomy</i>					
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

HR 85 Q 5002

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <i>Unnamed Ditch</i>	LOCATION <i>FTMC</i>	
STATION # <i>HR 85 Q</i> RIVERMILE _____	STREAM CLASS _____	
LAT <i>5002</i> LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <i>EPA</i>	
INVESTIGATORS <i>R S Prann, M. Murray, L Yates</i>		
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/9/03</i> TIME <i>12:30</i> AM <input checked="" type="radio"/> PM <input type="radio"/>	REASON FOR SURVEY <i>BERA Sampling</i>

WEATHER CONDITIONS	Now	Past 24 hours	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	<input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input checked="" type="checkbox"/> 20% %cloud cover <input checked="" type="checkbox"/> clear/sunny	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % <input checked="" type="checkbox"/>	Air Temperature _____ °C <i>85°F</i> Other _____

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) <i>See - Work Plan - Fig 9-4</i> <i>Appears to be drainage ditch between 2 ranges. -</i> <i>see also site photos</i>
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STREAM CHARACTERIZATION	Stream Subsystem <input type="checkbox"/> Perennial <input checked="" type="checkbox"/> Intermittent <input type="checkbox"/> Tidal	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater
	Stream Origin <input type="checkbox"/> Glacial <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Swamp and bog	Catchment Area _____ km ² <input type="checkbox"/> Spring-fed <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Other <i>upstream - prob. ground water</i>

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(BACK)

HR 8525002

WATERSHED FEATURES	Predominant Surrounding Landuse <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <i>old farm ranges</i> <input type="checkbox"/> Residential		Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input checked="" type="checkbox"/> Obvious sources
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <i>grasses in field - sedges - rushes near stream</i>		
INSTREAM FEATURES <i>Appears to be drainage ditch</i>	Estimated Reach Length <u>5</u> m Estimated Stream Width <u>0.2</u> m Sampling Reach Area <u>—</u> m ² Area in km ² (m ² x1000) <u>—</u> km ² Estimated Stream Depth <u>0.1</u> m Surface Velocity <u>0.2</u> m/sec (at thalweg)	Canopy Cover <input checked="" type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark <u>0.3</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle _____ % <input checked="" type="checkbox"/> Run <u>100</u> % <input type="checkbox"/> Pool _____ % Channelized <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
LARGE WOODY DEBRIS	LWD <u>—</u> m ² Density of LWD <u>—</u> m ² /km ² (LWD/ reach area)		
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input type="checkbox"/> Attached Algae dominant species present <i>- No vegetation noted</i> Portion of the reach with aquatic vegetation <u>0</u> %		
WATER QUALITY	Temperature <u>20.3</u> °C Specific Conductance <u>0.048</u> mS/cm Dissolved Oxygen <u>7.2</u> mg/L pH <u>6.73</u> Turbidity <u>—</u> WQ Instrument Used <i>Hanna V10</i>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globes <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____	
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	15
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	0	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	0			
Sand	0.06-2mm (gritty)	80%	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	20%			
Clay	< 0.004 mm (slick)	0			

HR 85 Q 5002

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>in name of Dept</i>	LOCATION <i>FTMC</i>
STATION # <i>HR 85 Q</i> RIVERMILE _____	STREAM CLASS _____
LAT <i>5002</i> LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>R S Frank, M. Murray, L. Yates</i>	
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/9/07</i> TIME <i>1230</i> AM <input checked="" type="checkbox"/>
REASON FOR SURVEY <i>BERA Sampling</i>	

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	10	7	4	2
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	10	7	4	2
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	10	7	4	2
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	10	7	4	2
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	10	7	4	2

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

HR 752 5002

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE ___ (LB)	Left Bank 10	6	4	
SCORE ___ (RB)	Right Bank 10	6		
9. Vegetative Protection (score each bank) More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE ___ (LB)	Left Bank 10	7		
SCORE ___ (RB)	Right Bank 10			
10. Riparian Vegetative Zone Width (score each bank riparian zone) Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
SCORE ___ (LB)	Left Bank 10			2
SCORE ___ (RB)	Right Bank 10			0

Parameters to be evaluated broader than sampling reach

Total Score _____

HR 85 Q SD 02

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

HR 85 Q SD 02

STREAM NAME <i>Unnamed Detel</i>	LOCATION <i>FTMC</i>
STATION # <i>085V</i> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY _____
INVESTIGATORS <i>RS Plann, M. Murray, L. Yuto</i>	LOT NUMBER _____
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/10/03</i> TIME <i>12:30</i> AM <input type="checkbox"/> PM <input checked="" type="checkbox"/>
	REASON FOR SURVEY <i>BECA Sampling</i>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <i>0</i> % <input type="checkbox"/> Snags <i>0</i> % <input type="checkbox"/> Vegetated Banks <i>100</i> % <input type="checkbox"/> Sand <i>80</i> % <input type="checkbox"/> Submerged Macrophytes <i>0</i> % <input type="checkbox"/> Other () %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input checked="" type="checkbox"/> Sand <i>1 + 1 CPOM</i> <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other () _____
GENERAL COMMENTS	<i>1 jabs + 1 CPOM sample collected as separate samples. Entire reach closest to "run".</i>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, ① = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	① 1 2 3 4	Slimes	① 1 2 3 4
Filamentous Algae	① 1 2 3 4	Macroinvertebrates	0 ① 2 3 4
Macrophytes	① 1 2 3 4	Fish	① 1 2 3 4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0 1 2 3 4	Anisoptera	0 1 2 3 4	Chironomidae	0 1 2 3 4
Hydrozoa	0 1 2 3 4	Zygoptera	0 1 2 3 4	Ephemeroptera	0 1 2 3 4
Platyhelminthes	0 1 2 3 4	Hemiptera	0 1 2 3 4	Trichoptera	0 1 2 3 4
Turbellaria	0 1 2 3 4	Coleoptera	0 1 2 3 4	Other	0 1 2 3 4
Hirudinea	0 1 2 3 4	Lepidoptera	0 1 2 3 4	<i>see results of lab taxonomy</i>	
Oligochaeta	0 1 2 3 4	Sialidae	0 1 2 3 4		
Isopoda	0 1 2 3 4	Corydalidae	0 1 2 3 4		
Amphipoda	0 1 2 3 4	Tipulidae	0 1 2 3 4		
Decapoda	0 1 2 3 4	Empididae	0 1 2 3 4		
Gastropoda	0 1 2 3 4	Simuliidae	0 1 2 3 4		
Bivalvia	0 1 2 3 4	Tabinidae	0 1 2 3 4		
		Culcidae	0 1 2 3 4		

HR 78Q SD01

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <u>Cane Creek</u>	LOCATION <u>FT MC</u>
STATION # <u>SD01</u> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <u>EPA</u>
INVESTIGATORS <u>RS Prann, M. Murray, L. Yates</u>	
FORM COMPLETED BY <u>M. Murray</u>	DATE <u>6/11/03</u> TIME <u>1450</u> AM <input checked="" type="checkbox"/> PM
	REASON FOR SURVEY <u>BERA sampling</u>

WEATHER CONDITIONS	Now	Past 24 hours	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	<input type="checkbox"/> storm (heavy rain)	<input type="checkbox"/>	Air Temperature <u>87°F</u>
	<input type="checkbox"/> rain (steady rain)	<input type="checkbox"/>	Other _____
	<input type="checkbox"/> showers (intermittent)	<input type="checkbox"/>	
	<input checked="" type="checkbox"/> 20% cloud cover	<input checked="" type="checkbox"/> % _____	
	<input type="checkbox"/> clear/sunny	<input checked="" type="checkbox"/>	

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)
	<p>See Figure 9-4 in BERA Plan - site photos</p>

STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater
	Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Catchment Area _____ km ²

HK 1845001
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
 (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <u>old mining range</u> <input type="checkbox"/> Residential		Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input checked="" type="checkbox"/> Obvious sources
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Red maple</u>		
INSTREAM FEATURES	Estimated Reach Length <u>120</u> m Estimated Stream Width <u>2</u> m Sampling Reach Area _____ m ² Area in km ² (m ² x1000) _____ km ² Estimated Stream Depth <u>0.2</u> m Surface Velocity <u>0.25</u> m/sec (at thalweg)	Canopy Cover <input checked="" type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark <u>1</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <u>50</u> % <input type="checkbox"/> Run <u>50</u> % <input type="checkbox"/> Pool _____ % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
LARGE WOODY DEBRIS	LWD <u>0</u> m ² Density of LWD <u>0</u> m ² /km ² (LWD/ reach area)		
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present <u>Algal film</u> Portion of the reach with aquatic vegetation <u>90</u> %		
WATER QUALITY	Temperature <u>23.1</u> °C Specific Conductance <u>0.023</u> uS/cm Dissolved Oxygen <u>8.42</u> mg/L pH <u>6.2</u> Turbidity _____ WQ Instrument Used <u>Hanna U10</u>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____	
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	0
Boulder	> 256 mm (10")	30			
Cobble	64-256 mm (2.5"-10")	50	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	15			
Sand	0.06-2mm (gritty)	45	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	0			
Clay	< 0.004 mm (slick)	0			

HR 77 Q SD 01

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>Cane Creek</i>	LOCATION <i>FTMC</i>	
STATION # <i>SD 10</i> RIVERMILE	STREAM CLASS	
LAT <i>34° 01' 40"</i> LONG	RIVER BASIN	
STORET #	AGENCY <i>EPA</i>	
INVESTIGATORS <i>R.S. Prann, M. Murray, L. Yates</i>		
FORM COMPLETED BY <i>M. Murray</i>	DATE TIME <i>6/11/03</i> <i>1:50</i> AM <input checked="" type="radio"/> PM	REASON FOR SURVEY <i>BERA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE				
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE				
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE				
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE				
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE				

Parameters to be evaluated in sampling reach

HR 78Q 50 01

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE __ (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE __ (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
9. Vegetative Protection (score each bank) More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE __ (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE __ (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
SCORE __ (LB)	Left Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0
SCORE __ (RB)	Right Bank 10 9 8 7 6	5 4 3 2 1 0	10 9 8 7 6	5 4 3 2 1 0

Parameters to be evaluated broader than sampling reach

Total Score _____

HR 78 Q 50 01

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <u>Cane Creek</u>		LOCATION <u>FT MC</u>	
STATION # <u>5001</u> RIVERMILE		STREAM CLASS <u>-</u>	
LAT _____	LONG _____	RIVER BASIN	
STORET #		AGENCY <u>EPA</u>	
INVESTIGATORS <u>RS Prann M. Murray L Yates</u>		LOT NUMBER	
FORM COMPLETED BY <u>M. Murray</u>		DATE <u>6/12/03</u>	REASON FOR SURVEY <u>BERA Sampling</u>
		TIME <u>1:55</u> AM (P)	

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <u>50</u> % <input type="checkbox"/> Snags <u>0</u> % <input type="checkbox"/> Vegetated Banks <u>50</u> % <input type="checkbox"/> Sand <u>5</u> % <input type="checkbox"/> Submerged Macrophytes <u>0</u> % <input type="checkbox"/> Other (_____) _____ %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other (<u>1 in riffle</u>) (<u>1 in run</u>)
GENERAL COMMENTS	<u>1 riffle and 1 run sample collected and composited</u> <u>1 CPOM sample collected as separate sample</u>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4	<i>see results of lab taxonomy</i>					
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

SAR 77 SD 25

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

(FRONT)

STREAM NAME <i>Unnamed Detch tributary to Conc Cr.</i>	LOCATION <i>FT MC Range 21</i>
STATION # <i>1025</i> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>RS Prann, M. Murray, L. Yates</i>	
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/12/03</i> TIME <i>0800</i> <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM REASON FOR SURVEY <i>BERA sampling</i>

WEATHER CONDITIONS	<p>Now</p> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input checked="" type="checkbox"/> 90% cloud cover <input type="checkbox"/> clear/sunny	<p>Past 24 hours</p> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> % <input type="checkbox"/>	<p>Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Air Temperature <i>80°F</i></p> <p>Other _____</p>
	<p>SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)</p> <p><i>See Figure 9-4 BERA Plan. Stream very small - flows through ~ 24" diameter pipe under road. Also see site photos</i></p>		
STREAM CHARACTERIZATION	<p>Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal</p> <p>Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____</p>	<p>Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater</p> <p>Catchment Area _____ km²</p>	

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

SAR 77 SD 25 (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Agricultural <input type="checkbox"/> Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input checked="" type="checkbox"/> Other <u>firm ranges</u>	Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input checked="" type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Alder - Red maple</u>	
INSTREAM FEATURES	Estimated Reach Length <u>10</u> m Estimated Stream Width <u>1.0</u> m Sampling Reach Area <u>—</u> m ² Area in km ² (m ² x1000) <u>—</u> km ² Estimated Stream Depth <u>0.1</u> m Surface Velocity <u>0.1</u> m/sec (at thalweg)	Canopy Cover <input type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input checked="" type="checkbox"/> Shaded High Water Mark <u>0.5</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle _____ % <input type="checkbox"/> Pool _____ % <input checked="" type="checkbox"/> Run <u>100</u> % Channelized <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
LARGE WOODY DEBRIS	LWD <u>0</u> m ² Density of LWD <u>0</u> m ² /km ² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Rooted emergent <input type="checkbox"/> Floating Algae <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Attached Algae <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating dominant species present <u>grasses - rushes - also arrowweed + polygnum</u> Portion of the reach with aquatic vegetation <u>50</u> %	
WATER QUALITY	Temperature <u>19.8</u> °C Specific Conductance <u>0.017</u> mscm Dissolved Oxygen <u>8.43</u> mg/L pH <u>5.83</u> Turbidity _____ WQ Instrument Used <u>Horiba UO</u>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Petroleum <input type="checkbox"/> Fishy <input type="checkbox"/> Sewage <input type="checkbox"/> Chemical <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input checked="" type="checkbox"/> None <input type="checkbox"/> Sheen <input type="checkbox"/> Other _____ <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Turbid <input type="checkbox"/> Other _____
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Chemical <input type="checkbox"/> Other _____ <input type="checkbox"/> Sewage <input type="checkbox"/> Anaerobic <input type="checkbox"/> Petroleum <input type="checkbox"/> None	Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Relict shells <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Other <u>silt</u> <input type="checkbox"/> Sand Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	50
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	5	Muck-Mud	black, very fine organic (FPOM)	50
Gravel	2-64 mm (0.1"-2.5")	5			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	75%			
Clay	< 0.004 mm (slick)	0			

SAR 77 SO 25

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>Cummins Pt. W. Creek</i>	LOCATION <i>FTMC Range 21</i>
STATION # <i>SD 25</i> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>R.S. Prann, M. Murray, Yates</i>	
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/2/03</i> TIME <i>0800</i> <input checked="" type="radio"/> AM <input type="radio"/> PM
	REASON FOR SURVEY <i>DEPA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.	
SCORE	10	6	3	1
2. Embeddedness Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.	
SCORE	10	6	3	1
3. Velocity/Depth Regime All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).	
SCORE	10	6	3	1
4. Sediment Deposition Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	10	6	3	1
5. Channel Flow Status Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	10	6	3	1

SAR 77 50 25

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20, 19, 18, 17, 16	15, 14, 13, 12, 11	10, 9, 8, 7, 6	5, 4, 3, 2, 1, 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20, 19, 18, 17, 16	15, 14, 13, 12, 11	10, 9, 8, 7, 6	5, 4, 3, 2, 1, 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE __ (LB)	Left Bank 10	10	6	0
SCORE __ (RB)	Right Bank 0	0	6	0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE __ (LB)	Left Bank 10	10	6	0
SCORE __ (RB)	Right Bank 10	10	6	0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE __ (LB)	Left Bank 10	10	6	0
SCORE __ (RB)	Right Bank 10	10	6	0

Parameters to be evaluated broader than sampling reach

Total Score _____

zone restricted by beavers but significant riparian vegetation present

SAR 77 5025

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <i>concrete Ditch/1.6 to Care Cr.</i>		LOCATION <i>FTMC Range 21</i>	
STATION # <i>5025</i> RIVERMILE _____		STREAM CLASS _____	
LAT _____ LONG _____		RIVER BASIN _____	
STORET # _____		AGENCY <i>EPA</i>	
INVESTIGATORS <i>RS Prany Murray, Yates</i>		LOT NUMBER _____	
FORM COMPLETED BY <i>M. Murray</i>		DATE <i>6/12/03</i>	REASON FOR SURVEY <i>BCRA Sampling</i>
		TIME <i>2:02</i> AM PM	

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <i>0</i> % <input type="checkbox"/> Snags <i>0</i> % <input type="checkbox"/> Vegetated Banks <i>100</i> % <input type="checkbox"/> Sand <i>15</i> % <input type="checkbox"/> Submerged Macrophytes <i>0</i> % <input type="checkbox"/> Other (<i>silt</i>) <i>75</i> %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other (_____) _____
GENERAL COMMENTS	<i>2 jabs collected in run - (no riffle habitat) completed.</i> <i>1 CPOM sample collected</i> <i>6/12/03</i>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	<i>0</i> 1 2 3 4	Slimes	<i>0</i> 1 2 3 4
Filamentous Algae	<i>0</i> 1 2 3 4	Macroinvertebrates	0 1 <i>2</i> 3 4
Macrophytes	<i>0</i> 1 2 3 4	Fish	<i>0</i> 1 2 3 4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0 1 2 3 4	Anisoptera	0 1 <i>2</i> 3 4	Chironomidae	0 1 2 3 4
Hydrozoa	0 1 2 3 4	Zygoptera	0 1 2 3 4	Ephemeroptera	0 1 2 3 4
Platyhelminthes	0 1 2 3 4	Hemiptera	0 1 2 3 4	Trichoptera	0 1 2 3 4
Turbellaria	0 1 2 3 4	Coleoptera	0 1 2 3 4	Other	0 1 2 3 4
Hirudinea	0 1 2 3 4	Lepidoptera	0 1 2 3 4		
Oligochaeta	0 1 2 3 4	Sialidae	0 1 2 3 4		
Isopoda	0 1 2 3 4	Corydalidae	0 1 2 3 4		
Amphipoda	0 1 2 3 4	Tipulidae	0 1 2 3 4		
Decapoda	0 1 2 3 4	Empididae	0 1 2 3 4		
Gastropoda	0 1 2 3 4	Simuliidae	0 1 2 3 4		
Bivalvia	0 1 2 3 4	Tabinidae	0 1 2 3 4		
		Culcidae	0 1 2 3 4		

See results of lab taxonomy

SAR 77 50 23

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <i>Chumuck & Ditch/fnls</i>	LOCATION <i>FTMC Range 21</i>	
STATION # <i>SD 2</i> RIVERMILE _____	STREAM CLASS _____	
LAT _____ LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <i>EPA</i>	
INVESTIGATORS <i>RS Prann, Murray, L Yates</i>		
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/2/03</i> TIME <i>0930</i> <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM	REASON FOR SURVEY <i>BERA Sampling</i>

WEATHER CONDITIONS	Now	Past 24 hours	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	<input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input checked="" type="checkbox"/> 90% cloud cover <input type="checkbox"/> clear/sunny	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> % <input type="checkbox"/>	Air Temperature <i>85°F</i> Other _____

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) <i>See Figure 9-4 BERA Plan. - site photos</i>
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STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater
	Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Catchment Area _____ km ²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

SAR 77 SD 23 (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Agricultural <input type="checkbox"/> Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input checked="" type="checkbox"/> Other <u>old firing ramp</u>	Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input checked="" type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Alder-red maple</u>	
INSTREAM FEATURES	Estimated Reach Length <u>10</u> m Estimated Stream Width <u>0.5</u> m Sampling Reach Area <u>—</u> m ² Area in km ² (m ² x1000) <u>—</u> km ² Estimated Stream Depth <u>0.1</u> m Surface Velocity <u>0.1</u> m/sec	Canopy Cover <input type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input checked="" type="checkbox"/> Shaded High Water Mark <u>0.5</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <u>70</u> % <input type="checkbox"/> Pool <u>—</u> % <input type="checkbox"/> Run <u>90</u> % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
LARGE WOODY DEBRIS	LWD <u>—</u> m ² Density of LWD <u>—</u> m ² /km ² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Rooted emergent <input type="checkbox"/> Floating Algae <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Attached Algae <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating dominant species present <u>Sagittaria - most water plants are in floodplain</u> Portion of the reach with aquatic vegetation <u>5</u> %	
WATER QUALITY	Temperature <u>19.0</u> °C Specific Conductance <u>0.013</u> mS/cm Dissolved Oxygen <u>7.53</u> mg/L pH <u>5.49</u> Turbidity <u>—</u> WQ Instrument Used <u>Hanna U10</u>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Petroleum <input type="checkbox"/> Fishy <input type="checkbox"/> Sewage <input type="checkbox"/> Chemical <input type="checkbox"/> Other Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input checked="" type="checkbox"/> None <input type="checkbox"/> Other <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Turbid <input type="checkbox"/> Other
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Chemical <input type="checkbox"/> Other <input type="checkbox"/> Sewage <input type="checkbox"/> Anaerobic <input type="checkbox"/> Petroleum <input type="checkbox"/> None Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Relict shells <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Other Looking at stones which are not deeply embedded, are the undersides black in color? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <u>- No stones</u>

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	30
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	0	Muck-Mud	black, very fine organic (FPOM)	30
Gravel	2-64 mm (0.1"-2.5")	0			
Sand	0.06-2mm (gritty)	75	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	2.5			
Clay	< 0.004 mm (slick)	0			

SAR 77 50 23

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>unnamed trib</i>		LOCATION <i>FTMC Range 21</i>	
STATION # <i>5023</i> RIVERMILE		STREAM CLASS <i>-</i>	
LAT _____	LONG _____	RIVER BASIN _____	
STORET # _____		AGENCY <i>EPA</i>	
INVESTIGATORS <i>RS Prang, L. Yates, M. Murray</i>			
FORM COMPLETED BY <i>M. Murray</i>		DATE <i>8/12/03</i> TIME <i>0930</i> AM PM	REASON FOR SURVEY <i>BERA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/Available Cover Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.	
SCORE	10	6	3	0
2. Embeddedness Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.	
SCORE	10	7	4	0
3. Velocity/Depth Regime All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).	
SCORE	10	7	4	0
4. Sediment Deposition Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	10	6	3	0
5. Channel Flow Status Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	10	7	4	0

Parameters to be evaluated in sampling reach

SAR 77 SD 23

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent; small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
Note: determine left or right side by facing downstream.				
SCORE __ (LB)	Left Bank 10	0 1 2 3 4 5 6		
SCORE __ (RB)	Right Bank 10	0 1 2 3 4 5 6		
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE __ (LB)	Left Bank 10	0 1 2 3 4 5 6		
SCORE __ (RB)	Right Bank 10	0 1 2 3 4 5 6		
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE __ (LB)	Left Bank 10	0 1 2 3 4 5 6		
SCORE __ (RB)	Right Bank 10	0 1 2 3 4 5 6		

Parameters to be evaluated broader than sampling reach

Total Score _____

SAR 77 SD 23

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <i>unwashed crib</i>	LOCATION <i>FTMC Range 21</i>
STATION # <i>5023</i> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>RS Pauer, Murray Vafca</i>	LOT NUMBER _____
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/12/03</i> TIME <i>0730</i> <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM
	REASON FOR SURVEY <i>BERA sampling</i>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble _____% <input type="checkbox"/> Snags _____% <input type="checkbox"/> Vegetated Banks _____% <input type="checkbox"/> Sand <i>75</i> % <input type="checkbox"/> Submerged Macrophytes _____% <input type="checkbox"/> Other (<i>silt</i>) <i>25</i> %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other (_____) _____
GENERAL COMMENTS	<i>2 jabs in run composites 1 CPOM sample collected</i>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	<input type="radio"/> 0 1 2 3 4	Slimes	<input checked="" type="radio"/> 0 1 2 3 4
Filamentous Algae	<input type="radio"/> 0 1 2 3 4	Macroinvertebrates	0 <input checked="" type="radio"/> 2 3 4
Macrophytes	<input type="radio"/> 0 1 2 3 4	Fish	<input type="radio"/> 0 1 2 3 4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0 1 2 3 4	Anisoptera	0 1 2 3 4	Chironomidae	0 1 2 3 4
Hydrozoa	0 1 2 3 4	Zygoptera	0 1 2 3 4	Ephemeroptera	0 1 2 3 4
Platyhelminthes	0 1 2 3 4	Hemiptera	0 1 2 3 4	Trichoptera	0 1 2 3 4
Turbellaria	0 1 2 3 4	Coleoptera	0 1 2 3 4	Other	0 1 2 3 4
Hirudinea	0 1 2 3 4	Lepidoptera	0 1 2 3 4	<i>See results of lab taxonomy</i>	
Oligochaeta	0 1 2 3 4	Sialidae	0 1 2 3 4		
Isopoda	0 1 2 3 4	Corydalidae	0 1 2 3 4		
Amphipoda	0 1 2 3 4	Tipulidae	0 1 2 3 4		
Decapoda	0 1 2 3 4	Empididae	0 1 2 3 4		
Gastropoda	0 1 2 3 4	Simuliidae	0 1 2 3 4		
Bivalvia	0 1 2 3 4	Tabinidae	0 1 2 3 4		
		Culicidae	0 1 2 3 4		

AR 802 SD 03 Range 24

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <i>Unconed Trip</i>	LOCATION <i>FTMC Range 24</i>	
STATION # <i>SD 03</i> RIVERMILE _____	STREAM CLASS _____	
LAT _____ LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <i>EPA</i>	
INVESTIGATORS <i>RS Prann, M. Murray, L Yates</i>		
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/12/03</i> TIME <i>10:45</i> AM PM	REASON FOR SURVEY <i>BERA sampling</i>

WEATHER CONDITIONS	Now <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input checked="" type="checkbox"/> 50% showers (intermittent) <input type="checkbox"/> %cloud cover <input type="checkbox"/> clear/sunny	Past 24 hours <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> % <input type="checkbox"/>	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Air Temperature <i>85°F</i> Other _____
	SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph) <p style="text-align: center;"><i>See Figure 9-4 BERA Sampling Plan Site photos</i></p>		
STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater Catchment Area _____ km ²	

H 12704 1103
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
 (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <u>old farming ranges</u> <input type="checkbox"/> Residential		Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input checked="" type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources
			Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Dogwood? Curnus sp.</u>		
INSTREAM FEATURES	Estimated Reach Length <u>10</u> m Estimated Stream Width <u>1.0</u> m Sampling Reach Area <u> </u> m ² Area in km ² (m ² x1000) <u> </u> km ² Estimated Stream Depth <u>0.2</u> m Surface Velocity <u>0.25</u> m/sec (at thalweg)	Canopy Cover <input type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input checked="" type="checkbox"/> Shaded High Water Mark <u>0.75</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <u>50</u> % <input type="checkbox"/> Run <u>50</u> % <input type="checkbox"/> Pool <u> </u> %	Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
LARGE WOODY DEBRIS	LWD <u>1.0</u> m ² Density of LWD <u> </u> m ² /km ² (LWD/ reach area)		
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present <u> </u> Portion of the reach with aquatic vegetation <u>5</u> %		
WATER QUALITY	Temperature <u>19.2</u> °C Specific Conductance <u>0.014</u> mS/cm Dissolved Oxygen <u>9.01</u> mg/L pH <u>5.89</u> Turbidity <u> </u> WQ Instrument Used <u>Horiba U10</u>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other <u> </u>	Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other <u> </u> Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained
SEDIMENT/SUBSTRATE	Odors <input type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anagrobic <input type="checkbox"/> None <input checked="" type="checkbox"/> Other <u>misty?</u>	Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other <u> </u>	Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		20	Detritus	sticks, wood, coarse plant materials (CPOM)	< 5
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	15	Marl	grey, shell fragments	0
Sand	0.06-2mm (gritty)	5			
Silt	0.004-0.06 mm	0			
Clay	< 0.004 mm (slick)	0			

HR 80 Q SD 03

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>unnamed Trib</i>	LOCATION <i>FTMC - Rump</i>	
STATION # <i>5003</i> RIVERMILE	STREAM CLASS <i>-</i>	
LAT _____ LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <i>EPA</i>	
INVESTIGATORS <i>R S Prank, L Yates, M. Murray</i>		
FORM COMPLETED BY <i>M. Murray</i>	DATE TIME <i>11/2/03 10:45 AM</i>	REASON FOR SURVEY <i>BERA sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient). SCORE	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2. Embeddedness Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. SCORE	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3. Velocity/Depth Regime All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.) SCORE	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. SCORE	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5. Channel Flow Status Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. SCORE	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.

Parameters to be evaluated in sampling reach

4R 80250 03

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE ___ (LB)	Left Bank 10 9 8 7 6			
SCORE ___ (RB)	Right Bank 10 9 8 7 6			
9. Vegetative Protection (score each bank) More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE ___ (LB)	Left Bank 11 10 9 8 7 6			
SCORE ___ (RB)	Right Bank 11 10 9 8 7 6			
10. Riparian Vegetative Zone Width (score each bank riparian zone) Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
SCORE ___ (LB)	Left Bank 10 9 8 7 6			
SCORE ___ (RB)	Right Bank 10 9 8 7 6			

Parameters to be evaluated broader than sampling reach

Total Score _____

banks too steep for much riparian zone

HR 802 SD 03

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <i>Unnaree Trib</i>	LOCATION <i>FTMC Range 24</i>
STATION # <i>5003</i> RIVERMILE	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY <i>EPA</i>
INVESTIGATORS <i>R. S. Pravin, Murthy, Yada</i>	LOT NUMBER
FORM COMPLETED BY <i>M. Murthy</i>	DATE <i>6/24/03</i> TIME <i>10:45</i> AM PM
	REASON FOR SURVEY <i>BERA sampling</i>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <i>40</i> % <input type="checkbox"/> Snags <i>45</i> % <input type="checkbox"/> Vegetated Banks <i>20</i> % <input type="checkbox"/> Sand <i>5</i> % <input type="checkbox"/> Submerged Macrophytes <i>0</i> % <input type="checkbox"/> Other () %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other () _____
GENERAL COMMENTS	<i>1 jab riddle & 1 run composited 1 CPOM sample collected separately</i>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0	1	<i>2</i>	3	4	Slimes	<i>2</i>	1	2	3	4
Filamentous Algae	<i>2</i>	1	2	3	4	Macroinvertebrates	0	<i>1</i>	2	3	4
Macrophytes	<i>2</i>	1	2	3	4	Fish	<i>2</i>	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	<i>2</i>	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

*many caddis on rocks
see results of lab taxonomy*

HR 802 SD06

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <u>unnamed Trib</u>	LOCATION <u>FTMC Range 24 upper</u>
STATION # <u>SD06</u> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <u>EPA</u>
INVESTIGATORS <u>RS Prany, C. L. et al M. Murray</u>	
FORM COMPLETED BY <u>M. Murray</u>	DATE <u>6/12/03</u> TIME <u>12:05</u> AM <input checked="" type="radio"/> PM
	REASON FOR SURVEY <u>BERA Sampling</u>

WEATHER CONDITIONS	Now	Past 24 hours	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	<input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input checked="" type="checkbox"/> 50% showers (intermittent) <input type="checkbox"/> %cloud cover <input type="checkbox"/> clear/sunny	<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> %	Air Temperature <u>85°F</u> Other _____

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) <p style="text-align: center;">See Figure 9-4 BERA Plan. — site photos</p>
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STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater
	Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Catchment Area _____ km ²

HR 802 SD 06
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
 (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <i>old firing ranges</i> <input type="checkbox"/> Residential		Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input checked="" type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources
	Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy		
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Alden</u>		
INSTREAM FEATURES	Estimated Reach Length <u>20</u> m Estimated Stream Width <u>1</u> m Sampling Reach Area _____ m ² Area in km ² (m ² x1000) _____ km ² Estimated Stream Depth <u>0.1</u> m Surface Velocity (at thalweg) <u>0.2</u> m/sec	Canopy Cover <input type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input checked="" type="checkbox"/> Shaded High Water Mark <u>1</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <u>50</u> % <input type="checkbox"/> Run <u>50</u> % <i>(40 mm d/d)</i> <input type="checkbox"/> Pool <u>10</u> % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
LARGE WOODY DEBRIS	LWD <u>2</u> m ² Density of LWD _____ m ² /km ² (LWD/ reach area)		
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation <u>45</u> %		
WATER QUALITY	Temperature <u>19.9</u> °C Specific Conductance <u>0.012</u> mS/cm Dissolved Oxygen <u>7.85</u> mg/L pH <u>5.87</u> Turbidity _____ WQ Instrument Used <u>Horiba U10</u>	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____	
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	35			
Sand	0.06-2mm (gritty)	5	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	0			
Clay	< 0.004 mm (slick)	0			

HR 80 Q SD 06

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>un name & trib.</i>	LOCATION <i>FTMC Camp 24 upper</i>	
STATION # <i>SD 06</i> RIVERMILE _____	STREAM CLASS _____	
LAT _____ LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY <i>EPA</i>	
INVESTIGATORS <i>BS Pranu, M. Murray, L. Vetter</i>		
FORM COMPLETED BY <i>M. Murray</i>	DATE TIME <i>9/20/03</i> <i>12:05</i> AM <input checked="" type="checkbox"/> PM	REASON FOR SURVEY <i>BCRA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE				
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE				
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE				
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE				
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE				

Parameters to be evaluated in sampling reach

HR 802 SD 06

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE __ (LB)	Left Bank 10	2		
SCORE __ (RB)	Right Bank 10	2		
9. Vegetative Protection (score each bank) More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE __ (LB)	Left Bank 10	6		
SCORE __ (RB)	Right Bank 10	6		
10. Riparian Vegetative Zone Width (score each bank riparian zone) Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
SCORE __ (LB)	Left Bank 10			
SCORE __ (RB)	Right Bank 10			

Parameters to be evaluated broader than sampling reach

Total Score _____

not due to human activity but to characteristics of this small tributary

HR 20 Q 50 06

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <i>Winnipeg Trib</i>	LOCATION <i>PTMC Range 24 upper</i>
STATION # <i>50 06</i> RIVERMILE	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY <i>EPA</i>
INVESTIGATORS <i>R. Spann, Murray, Yates</i>	LOT NUMBER
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>6/2/03</i> TIME <i>12:05</i> AM <input checked="" type="checkbox"/> PM
	REASON FOR SURVEY <i>BEBA sampling</i>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <i>40</i> % <input type="checkbox"/> Snags <i>10</i> % <input type="checkbox"/> Vegetated Banks <i>30</i> % <input type="checkbox"/> Sand <i>5</i> % <input type="checkbox"/> Submerged Macrophytes <i>0</i> % <input type="checkbox"/> Other () _____%
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other () _____
GENERAL COMMENTS	<i>1 each riffle from collected & composited. 1 CPOM sample collected separately</i>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0	<input checked="" type="radio"/> 1	2	3	4	Slimes	<input checked="" type="radio"/> 1	2	3	4	
Filamentous Algae	<input checked="" type="radio"/> 0	1	2	3	4	Macroinvertebrates	0	<input checked="" type="radio"/> 1	2	3	4
Macrophytes	<input checked="" type="radio"/> 0	1	2	3	4	Fish	0	1	<input checked="" type="radio"/> 2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	<input checked="" type="radio"/> 1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4	<i>see lab taxonomy results</i>					
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabanidae	0	1	2	3	4						
						Culicidae	0	1	2	3	4						

SW 51 Reference Station

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME <u>Reference Str.</u>	LOCATION <u>ETMC Reference Station</u>
STATION # <u>10R06</u> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <u>EPA</u>
INVESTIGATORS <u>R S Prann, M. Murray, L. Yates</u>	
FORM COMPLETED BY <u>M. Murray</u>	DATE <u>6/12/03</u> TIME <u>1340</u> AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>
	REASON FOR SURVEY <u>BERA Sampling</u>

WEATHER CONDITIONS	<input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input checked="" type="checkbox"/> showers (intermittent) <input checked="" type="checkbox"/> %cloud cover <input type="checkbox"/> clear/sunny	Now <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input checked="" type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover <input type="checkbox"/> clear/sunny	Past 24 hours <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input checked="" type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover <input type="checkbox"/> clear/sunny	Has there been a heavy rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Air Temperature <u>82</u> °F Other _____
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SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) <p style="text-align: center;">See Figure 9-4 BERA plan - site photos</p>
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STREAM CHARACTERIZATION	Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater
	Stream Origin <input type="checkbox"/> Glacial <input checked="" type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	Catchment Area _____ km ²

SW 511 (Letcher) Station
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
 (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input type="checkbox"/> Other _____ <input type="checkbox"/> Residential		Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input checked="" type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources <input type="checkbox"/> Obvious sources <i>road</i>
RIPARIAN VEGETATION (18 meter buffer)	Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy		
INSTREAM FEATURES	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Dogwood? Cornus sp.</u>		
LARGE WOODY DEBRIS	Estimated Reach Length <u>30</u> m Estimated Stream Width <u>2</u> m Sampling Reach Area _____ m ² Area in km ² (m ² x1000) _____ km ² Estimated Stream Depth <u>0.2</u> m Surface Velocity <u>0.25</u> m/sec (at thalweg)		
AQUATIC VEGETATION	Canopy Cover <input type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input checked="" type="checkbox"/> Shaded High Water Mark <u>1</u> m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle <u>70</u> % <input type="checkbox"/> Run <u>20</u> % <input type="checkbox"/> Pool <u>10</u> % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
WATER QUALITY	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation <u>50</u> %		
SEDIMENT/SUBSTRATE	LWD <u>1</u> m ² Density of LWD _____ m ² /km ² (LWD/ reach area)		
WATER QUALITY	Temperature <u>19.8</u> °C Specific Conductance <u>0.015</u> mS/cm Dissolved Oxygen <u>9.22</u> mg/L pH <u>6.08</u> Turbidity _____ WQ Instrument Used <u>Hanna U10</u>		
SEDIMENT/SUBSTRATE	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____		
SEDIMENT/SUBSTRATE	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		<u>10</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>5</u>
Boulder	> 256 mm (10")	<u>25</u>			
Cobble	64-256 mm (2.5"-10")	<u>40</u>	Muck-Mud	black, very fine organic (FPOM)	<u>0</u>
Gravel	2-64 mm (0.1"-2.5")	<u>20</u>			
Sand	0.06-2mm (gritty)	<u>5</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>0</u>			
Clay	< 0.004 mm (slick)	<u>0</u>			

sw SD Reference Station

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <i>Reference Stream</i>	LOCATION <i>FTMC Reference Station</i>
STATION # <i>SD Ref.</i> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>EPA</i>
INVESTIGATORS <i>RS Prunty, M. Murray, L. Yates</i>	
FORM COMPLETED BY <i>M. Murray</i>	DATE <i>8/12/03</i> AM <input checked="" type="radio"/> PM <input type="radio"/>
	REASON FOR SURVEY <i>BERA Sampling</i>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	10	7	4	1
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	10	7	4	1
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	10	7	4	1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	10	7	4	1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	10	7	4	1

Parameters to be evaluated in sampling reach

SW 50 Reference Station

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
Note: determine left or right side by facing downstream.				
SCORE ___ (LB)	Left Bank 10	9	8	7
SCORE ___ (RB)	Right Bank 10	9	8	7
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10	9	8	7
SCORE ___ (RB)	Right Bank 10	9	8	7
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10	9	8	7
SCORE ___ (RB)	Right Bank 10	9	8	7

Parameters to be evaluated broader than sampling reach

Total Score _____

riparian zone small due to steepness of terrain

SW 50 Reference Station

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <i>Reference Str.</i>	LOCATION <i>FTMC Reference Station</i>
STATION # <i>SD 001</i> RIVERMILE _____	STREAM CLASS _____
LAT _____ LONG _____	RIVER BASIN _____
STORET # _____	AGENCY <i>GPA</i>
INVESTIGATORS <i>RS Proun, Murray, Yates</i>	LOT NUMBER _____
FORM COMPLETED BY <i>Ms. Murray</i>	DATE <i>6/12/00</i> TIME <i>1310</i> AM <input checked="" type="checkbox"/> PM
	REASON FOR SURVEY <i>BERA Sampling</i>

HABITAT TYPES	Indicate the percentage of each habitat type present <input type="checkbox"/> Cobble <i>40</i> % <input type="checkbox"/> Snags <i>5</i> % <input type="checkbox"/> Vegetated Banks <i>50</i> % <input type="checkbox"/> Sand <i>5</i> % <input type="checkbox"/> Submerged Macrophytes <i>0</i> % <input type="checkbox"/> Other () %
SAMPLE COLLECTION	Gear used <input checked="" type="checkbox"/> D-frame <input type="checkbox"/> kick-net <input type="checkbox"/> Other _____ How were the samples collected? <input checked="" type="checkbox"/> wading <input type="checkbox"/> from bank <input type="checkbox"/> from boat Indicate the number of jabs/kicks taken in each habitat type. <input type="checkbox"/> Cobble _____ <input type="checkbox"/> Snags _____ <input type="checkbox"/> Vegetated Banks _____ <input type="checkbox"/> Sand _____ <input type="checkbox"/> Submerged Macrophytes _____ <input type="checkbox"/> Other () _____
GENERAL COMMENTS	<i>1 riffle and 1 run samples composited 1 CPOM sample separate</i>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0	1	2	<i>0</i>	4	Slimes	<i>0</i>	1	2	3	4
Filamentous Algae	<i>0</i>	1	2	3	4	Macroinvertebrates	0	<i>1</i>	2	3	4
Macrophytes	<i>0</i>	1	2	3	4	Fish	0	<i>1</i>	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3 = Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4	<i>See lab results</i>					
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

ATTACHMENT 5

**SHAW E&I GEOTECHNICAL LABORATORY REPORTS, PARTICLE
SIZE, AND LEAD PARTICULATE COUNTING SAMPLE DATA**



Geotechnical Laboratory
PO Box 4339
1570 Bear Creek Road
Oak Ridge TN 37830
865/482-6497

CERTIFICATE OF ANALYSIS

Duane Nielsen
Shaw E&I
312 Directors Drive
Knoxville TN 37923

August 7, 2003

This is the Certificate of Analysis for the following samples:

Project ID:	Fort McClellan
Project Number:	800486.03EECA01
Date Received by Lab:	May 16, 2003 and July 24, 2003
Number of Samples:	Twenty-four (24)
Sample Type:	Soil

I. Introduction/Case Narrative

Twenty-three soil samples were received by the Shaw Geotechnical Laboratory on May 16, 2003. One sample was submitted on July 24, 2003 to replace an earlier sample that had been consumed in testing. Samples were submitted for determination of particle-size distribution (grainsize) and lead particle counting. Not all samples required all analyses.

Twenty-three samples were originally tested in July, 2003 with results reported on July 21, 2003. Samples were retested for the lead separation technique using different particle-size criteria. This document reports results of these latter tests.

Please see Appendix A, Sample Number Cross Reference List; Appendix B, Analysis Results; and Appendix C, Chain-of-Custody and Request-for-Analysis Records.

Reviewed and Approved:

Ralph Cole
Laboratory Manager, Geotechnical Services

II. Analytical Results/Methodology

REFERENCES: United States Army Corps of Engineers (USACE), Engineer Manual 1110-2-1906, *Laboratory Soils Testing*, appendix II, 1970; United States Environmental Protection Agency, SW846, *Test Methods for Examining Solid Waste, Physical/Chemical Methods*, 3rd ed., Nov 1986 (EPA SW-846). Annual Book of ASTM Standards, Section 4, Construction, Volume 04.08, *Soil and Rock (I)*, and Volume 04.09, *Soil and Rock (II)*, 2003. Peddicord, Richard K. and Judy S. LaKind. *Ecological and Human Health Risks at an Outdoor Firing Range*. Environmental Toxicology and Chemistry, Vol. 19 No. 10. pp.2605.-

Laboratory Determination of Water (Moisture) Content of Soil and Rock.....ASTM D 2216
Lead Particle Separation in Game Bird Grit Sizes Peddicord and LaKind

III. Quality Control

Quality control checks such as duplicates and spikes (QC samples), are not normally applicable to geotechnical testing. This is due largely to the inability of obtaining samples with known characteristics, the heterogenous nature of the samples, and quality control procedures built-in to the analytical method.

QC measures to ensure accuracy and precision of test results include the following:

- 100% verification of all numerical results - raw data entries, transcriptions and calculations entered by lab technicians are checked, recalculated and verified. Most data calculations are performed by computer programs.
- Data validation through test reasonableness - summaries of all test results for individual reports are reviewed to determine the overall reasonableness of data and to determine the presence of any data that may be considered outliers.
- Quality control procedures are built into most standardized geotechnical procedures. For example, liquid limit and plastic limit analyses call for re-analyses and specify acceptance criteria.
- Routine instrument calibration - instruments, gauges and equipment used in testing are calibrated on a routine basis. All instrument calibration follows ASTM or manufacturer guidelines.
- Maintenance of all past calibration records - calibration records and certification documents of all instruments, gauges and equipment are updated routinely and maintained in the Quality Control Coordinators Quality/Operations files.

- Certified and trained personnel - all technicians are certified by the National Institute for Certification of Engineering Technicians (NICET) in geotechnical soil testing, and are trained in the application of standard laboratory procedures for geotechnical analyses as well as the quality assurance measures implemented by IT.

IV. Data Qualification

The lead separation procedure outlined by Peddicord and LaKind involves segregating soil particles with certain size ranges, and separating the fractions based on particle composition (lead vs. natural). The requested size ranges were from 0.8 mm to 2.2 mm, and from 2.8 to 4.2 mm. Wire-mesh test sieves were used to separate the soil particles into their respective size fractions. Non-lead particles were removed from the lead particles by using a water-flushing technique. Final separations were performed by hand. Metals other than lead (brass) were placed into the non-lead category.

However, there was no commercially available 4.2 mm test sieve. The samples were initially passed through a 4.75 mm sieve, and final grading was performed on individual particles using digital calipers to size particles at 4.2 mm nominal diameter.

After separating lead and non-lead particles into their respective size fractions, particles were counted and weighed. From this data the number and percentage of particles of each type was calculated for the gross sample volume (144 square inches).

The separation techniques are based on relative density of materials (water flushing) and visual appearances (hand grading). Metals other than lead could have been classified as lead if they had a similar appearance and were denser than soil particles.

Appendix A
Sample Cross-Reference List

SAMPLE NUMBER CROSS-REFERENCE LIST

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
BC0131	RW0001	Soil
BC0132	RW0002	Soil
BC0133	RW0004	Soil
BC0134	RW0005	Soil
BC0135	RW0006	Soil
BC0136	RW0007	Soil
BC0137	RW0008	Soil
BC0138	RW0009	Soil
BC0139	RW0010	Soil
BC0140	RW0012	Soil
BC0141	RW0013	Soil
BC0142	RW0014	Soil
BC0143	RW0015	Soil
BC0144	RW0016	Soil
BC0145	RW0017	Soil
BC0146	RW0018	Soil
BC0147	RW0019	Soil
BC0148	RW0021	Soil
BC0149	RW0022	Soil
BC0150	RW0023	Soil
BC0151	RW0024	Soil
BC0152	RW0025	Soil
BC0153	RW0026	Soil
BC0176	RW0001R	Soil

Appendix B
Sample Test Results

MOISTURE CONTENT

PROJECT NAME
Fort McClellan

PROJECT NUMBER
800486.03EECA01

IT LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE, % SW846	SOLIDS, % SW846
BC0176	RW0001R	15.2	13.2	86.8
BC0132	RW0002	28.0	21.9	78.1
BC0133	RW0004	17.0	14.5	85.5
BC0134	RW0005	44.3	30.7	69.3
BC0135	RW0006	78.3	21.7	78.3
BC0139	RW0010	20.6	17.0	83.0
BC0140	RW0012	22.2	18.2	81.8
BC0141	RW0013	18.8	15.8	84.2
BC0142	RW0014	29.9	23.0	77.0
BC0143	RW0015	50.6	33.6	66.4
BC0145	RW0017	42.5	29.8	70.2
BC0146	RW0018	8.8	8.1	91.9
BC0147	RW0019	29.7	22.9	77.1
BC0148	RW0021	134.7	57.4	42.6
BC0149	RW0022	78.0	43.8	56.2
BC0151	RW0024	41.5	29.3	70.7
BC0152	RW0025	38.0	27.6	72.4
BC0153	RW0026	42.0	29.6	70.4

ASTM D 2216 results are based on dry sample weight.
 SW846 results are based on wet sample weight.
 Solids content is determined by subtracting the SW846 moisture (%) from 100.

**GRIT-SIZE PARTICLE SEPARATION, LEAD
 after Peddicord and LaKind**

Project: Fort McClellan
 Project number: 800486.03EECA01

Lab sample ID	Client sample ID	4.2 mm to 2.8 mm				2.2 mm to 0.8 mm			
		No. Lead particles per gram soil	No. Lead particles in gross sample	% Lead particles	% Non-lead particles	No. Lead particles per gram soil	No. Lead particles in gross sample	% Lead particles	% Non-lead particles
BC0176	RW0001R	0.023	126.4	7.56	92.44	0.266	1436.7	6.38	93.62
BC0132	RW0002	0.013	18.2	4.02	95.98	0.180	246.2	2.08	97.92
BC0133	RW0004	0	0	0	100	0.013	36.3	0.36	99.64
BC0134	RW0005	0.009	15.0	4.73	95.27	0.035	58.2	0.96	99.04
BC0135	RW0006	0.018	44.3	4.80	95.20	0.301	744.8	2.54	97.46
BC0139	RW0010	0.005	10.0	0.80	99.20	0.288	637.0	0.88	99.12
BC0140	RW0012	0	0	0	100	0.002	6.2	0.17	99.83
BC0141	RW0013	0.019	47.5	3.02	96.98	0.059	148.3	0.45	99.55
BC0142	RW0014	0.001	1.9	0.56	99.44	0.007	13.4	0.26	99.74
BC0143	RW0015	0.003	4.2	8.57	91.43	0.022	35.7	1.56	98.44
BC0145	RW0017	0.001	2.3	2.64	97.36	0.008	15.4	0.36	99.64
BC0146	RW0018	0.001	5.8	0.15	99.85	0.025	100.8	0.13	99.87
BC0147	RW0019	0.003	7.2	2.33	97.67	0	163.5	0.63	99.37
BC0148	RW0021	0.010	10.9	45.83	54.17	0.151	166.4	10.42	89.58
BC0149	RW0022	0	0	0	100	0.083	71.7	2.34	97.66
BC0151	RW0024	0	0	0	100	0	0	0	100
BC0152	RW0025	0.007	12.8	3.22	96.78	0.025	46.4	0.30	99.70
BC0153	RW0026	0	0	0	100	0	0	0	100

Appendix C
Chain-of-Custody and Request-for-Analysis Records



IT CORPORATION

A Member of The IT Group

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-ETDC

Page 1 of 3

Project Number: 800486

Samples Shipment Date: 18 MAY 2003

Bill To: Duane Nielsen

Project Name: Fort McClellan

Lab Destination: IT Corporation Environmental Technology Deve

312 Directors Drive

Knoxville

TN 37923

Sample Coordinator: Oliver Allen

Lab Contact: Ralph Cole

Report To: Duane Nielsen

312 Directors Drive

Knoxville

TN 37923

Turnaround Time:

NOLMAK

Project Contact: Tim Roth

Carrier/Waybill No.: Fed Ex

Special Instructions: *800486. 03EECA 01*

Possible Hazard Identification:

Radiological

Non-hazard

Flammable

Skin Irritant

Poison B

Unknown

Sample Disposal:

Return to Client

Disposal by Lab

Archive

(mos.)

1. Relinquished By
(Signature/Affiliation) *D. Nielsen / SHAW*

Date: *05/16/03*
Time: *1200*

1. Received By
(Signature/Affiliation) *[Signature]*

SHAW E & I Date: *5/16/03*
OAK RIDGE Time: *1540*

2. Relinquished By
(Signature/Affiliation)

Date:
Time:

2. Received By
(Signature/Affiliation)

Date:
Time:

3. Relinquished By
(Signature/Affiliation)

Date:
Time:

3. Received By
(Signature/Affiliation)

Date:
Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
# 1	RW0001	HR-70Q-SS01-SS-RW0001-REG	13 MAY 2003	10:30	8 oz CW-JAR	1	None Required	Grain Size by ASTM D421/D422	RW 0001 BC 0131
	RW0001	HR-70Q-SS01-SS-RW0001-REG	13 MAY 2003	10:30	0 None POLY BAG	1	None except cool to 4 C	Particulate Bullet Fragment by Peddicord/La Kind	
# 2	RW0002	SAR-85-SS37-SS-RW0002-REG	06 MAY 2003	12:10	8 oz CW-JAR	1	None Required	Grain Size by ASTM D421/D422	RW 0002 BC 0132
	RW0002	SAR-85-SS37-SS-RW0002-REG	06 MAY 2003	12:10	0 None POLY BAG	1	None except cool to 4 C	Particulate Bullet Fragment by Peddicord/La Kind	
# 3	RW0004	SAR-85-SS34-SS-RW0004-REG	06 MAY 2003	10:00	8 oz CW-JAR	1	None Required	Grain Size by ASTM D421/D422	RW 0004 BC 0133
	RW0004	SAR-85-SS34-SS-RW0004-REG	06 MAY 2003	10:00	0 None POLY BAG	1	None except cool to 4 C	Particulate Bullet Fragment by Peddicord/La Kind	



IT CORPORATION

A Member of The IT Group

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: BERA-ETDC

Page 2 of 3

Sample No	Sample Name	Sample Date	Sample Time	Container	Preservative	Requested Testing Program	File CID	Condition On Receipt
# 4	RW0005	SAR-71-SS05-SS-RW0005-REG	08 MAY 2003	10:00	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
	RW0005	SAR-71-SS05-SS-RW0005-REG	08 MAY 2003	10:00	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
# 5	RW0006	SAR-71-SS09-SS-RW0006-REG	08 MAY 2003	10:50	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
	RW0006	SAR-71-SS09-SS-RW0006-REG	08 MAY 2003	10:50	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
# 6	RW0007	LMBC-REF1-SS-RW0007-REG	09 MAY 2003	08:15	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
	RW0008	LMBC-REF2-SS-RW0008-REG	12 MAY 2003	17:10	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
# 7	RW0009	LMBC-REF3-SS-RW0009-REG	13 MAY 2003	09:45	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
	RW0010	HR-77Q-SS01-SS-RW0010-REG	07 MAY 2003	10:00	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
# 8	RW0010	HR-77Q-SS01-SS-RW0010-REG	07 MAY 2003	10:00	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
	RW0012	SAR-78-SS34-SS-RW0012-REG	09 MAY 2003	09:30	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
# 9	RW0012	SAR-78-SS34-SS-RW0012-REG	09 MAY 2003	09:30	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
	RW0013	SAR-77-SS33-SS-RW0013-REG	07 MAY 2003	11:20	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
# 10	RW0013	SAR-77-SS33-SS-RW0013-REG	07 MAY 2003	11:20	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
	RW0014	HR-80Q-MW02-SS-RW0014-REG	07 MAY 2003	12:30	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
# 11	RW0014	HR-80Q-MW02-SS-RW0014-REG	07 MAY 2003	12:30	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
	RW0015	SAR-77-SS50-SS-RW0015-REG	12 MAY 2003	11:55	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
# 12	RW0015	SAR-77-SS50-SS-RW0015-REG	12 MAY 2003	11:55	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
	RW0016	MMBC-REF-SS-RW0016-REG	12 MAY 2003	10:45	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
# 13	RW0017	SAR-85-SS17-SS-RW0017-REG	13 MAY 2003	12:35	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
	RW0017	SAR-85-SS17-SS-RW0017-REG	13 MAY 2003	12:35	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
# 14	RW0018	SAR-78-SS25-SS-RW0018-REG	12 MAY 2003	09:40	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
	RW0018	SAR-78-SS25-SS-RW0018-REG	12 MAY 2003	09:40	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
# 15	RW0019	SAR-78-SS17-SS-RW0019-REG	07 MAY 2003	08:30	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
	RW0019	SAR-78-SS17-SS-RW0019-REG	07 MAY 2003	08:30	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
# 16	RW0021	SAR-89-SS11-SS-RW0021-REG	12 MAY 2003	18:00	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422
	RW0021	SAR-89-SS11-SS-RW0021-REG	12 MAY 2003	18:00	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
# 17	RW0022	SAR-85-SS02-SS-RW0022-REG	06 MAY 2003	08:15	0 None POLY BAG	1 None except cool to 4 C		Particulate Bullet Fragment by Peddicord/La Kind
	RW0022	SAR-85-SS02-SS-RW0022-REG	06 MAY 2003	08:15	8 oz CW-JAR	1 None Required		Grain Size by ASTM D421/D422

RW0005
BC 0134

RW0006
BC 0135

RW0007
BC 0136

RW0008
BC 0137

RW0009
BC 0138

RW0010
BC 0139

RW0012
BC 0140

RW0013
BC 0141

RW0014
BC 0142

RW0015
BC 0143

RW0016
BC 0144

RW0017
BC 0145

RW0018
BC 0146

RW0019
BC 0147

RW0021
BC 0148

RW0022
BC 0149



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: 70-072303-ETDC
Page 1 of 1

Project Number: 800486	Samples Shipment Date: 23 JUL 2003	Bill To: Duane Nielsen
Project Name: Fort McClellan	Lab Destination: IT Corporation Environmental Technology Deve	312 Directors Drive
Sample Coordinator: Keith Hague	Lab Contact: Ralph Cole	Knoxville TN 37923
Turnaround Time: <i>As per Randy McBride SHAW E&I</i>	Project Contact: Tim Roth	Report To: Duane Nielsen
	Carrier/Waybill No.: UPS/	312 Directors Drive
		Knoxville TN 37923

Special Instructions: None	
Possible Hazard Identification: <i>Lead</i> Radiological <input type="checkbox"/>	
Non-hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
Sample Disposal: Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/> Archive (mos.)	
1. Relinquished By (Signature/Affiliation) <i>Keith Hague SHAW E&I</i>	1. Received By (Signature/Affiliation) <i>[Signature] SHAW OAK RIDGE</i>
Date: <i>7/23/03</i>	Date: <i>7/24/03</i>
Time: <i>1400</i>	Time: <i>1010</i>
2. Relinquished By (Signature/Affiliation)	2. Received By (Signature/Affiliation)
Date:	Date:
Time:	Time:
3. Relinquished By (Signature/Affiliation)	3. Received By (Signature/Affiliation)
Date:	Date:
Time:	Time:
Comments: None	

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	File CID	Condition On Receipt
RW0001R	HR-70Q-SS01-SS-RW0001R-REG	23 JUL 2003	09:15	0 None POLY BAG	1	None except cool to 4 C	Particulate Bullet Fragment by Peddicord/La Kind	N	BC 0176

APPENDIX K
SITE PHOTOGRAPHS

Skeet Range Firing Line and Target House, facing east



Skeet Range Impact Zone, facing southeast



Range 19 Target Lines, facing north



Shaw Environmental & Infrastructure, Inc.

Iron Mountain Road Ranges
Site Photographs

Photo 3 of 12

Range 19 Impact Zone, facing east



Range 19 Impact Zone bullet fragments



Range 13 Historical Photo, facing southeast



Range 13 Firing Line, facing north





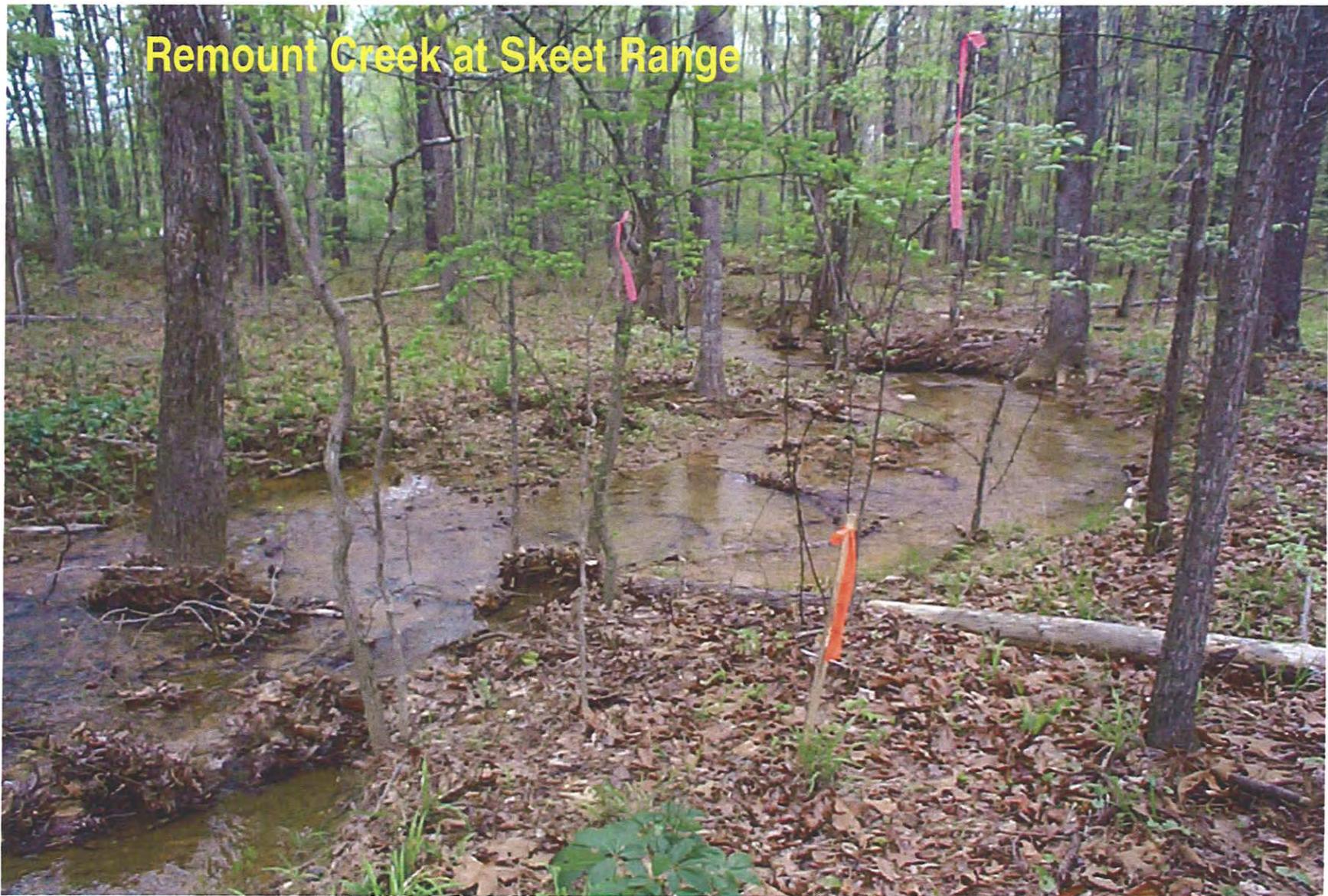
Range 12 Firing Line, facing east



Range 12 Impact Zone, facing northeast



Remount Creek at Skeet Range



Skeet Range Impact Zone, 2.75 inch rocket (UXO)

